AIR CONDITIONING HEATING AND VENTILATING

AUGUST 1960

For the Engineer Engaged in DESIGN APPLICATION ESTIMATING SPECIFICATION and LAYOUT

IN THIS ISSUE

School Air Conditioning — a Special Report ... 77

Design of Pneumatic Control Centers 69

Orifice Sizing Made Easy 57

Handling Fan Heat Loads 61

Data Sheet: Loads on Buried Pipe 86

Detail Sheet: Gas-Fired Unit Heaters 87

Full Contents on Page 3

School teachers are now aided in their work by better teaching environments and less outside distraction. Better teaching techniques are possible. For a special report on Educational and Economical Evaluation of School Air Conditioning, see page 77.

MARSH PACKLESS RADIATOR VALVES

WHEEL HANDLE

GRADUATED

LOCK AND SHIELD

ANGLE PATTERN

GLOBE PATTERN

CORNER PATTERN (Sectional Below)

MARSH THERMOSTATIC RADIATOR TRAPS

ANGLE PATTERN

STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN

RIGHT HAND CORNER PATTERN

CUT OPEN VALVE

F&T TRAPS

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VENTS

No. 5 VENT, ONE OF MANY

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No. 500 INVERTED BUCKET TRAP

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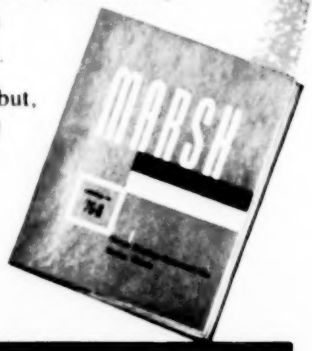

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Marsh Instrument & Valve Co. (Canada) Ltd.
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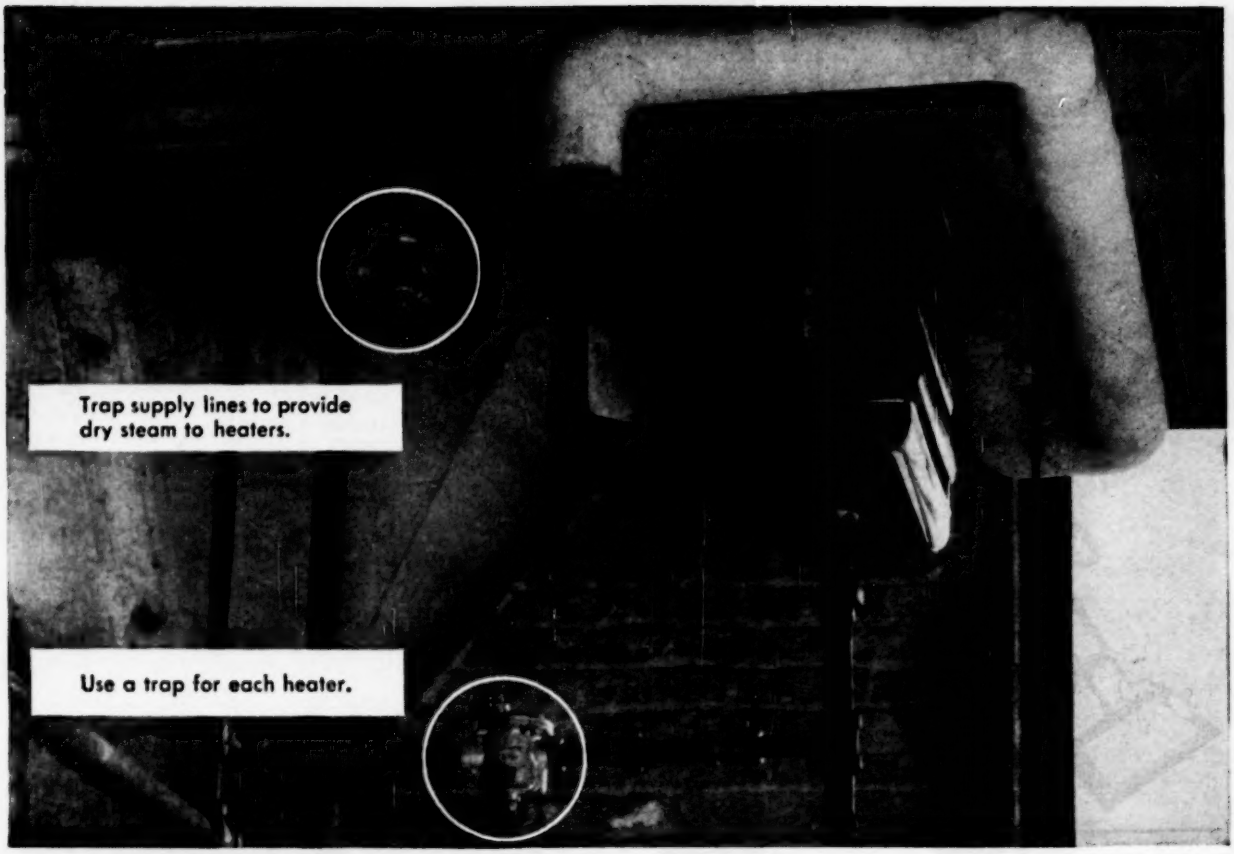

Tips on Trapping Unit Heaters for Full Output and Low Maintenance

• If unit heaters are clean and the steam supply and return lines are adequate, their performance will depend entirely upon the steam trapping. Here are some trapping pointers to insure plenty of heat when it is needed:

1. Trap supply lines to take care of condensate formed by radiation loss.

2. Use one trap for each heater. Two or more heaters drained by a single trap will fail to deliver maximum btu output.

3. Size traps properly. Many a unit heater is handicapped by a trap lacking adequate condensate and *air* handling capacity. The few dollars extra for larger traps insure fast heatup, full output and freedom from coil corrosion.

4. Install traps correctly. Put trap below and close to heater. Install a bypass around the trap if the heater must be kept in operation at all times. A shut-off valve in the discharge line facilitates trap inspection. Use of check valves and strainers is dependent upon piping conditions and the traps used.

5. Protect against PRV failure where freezing could occur. Sometimes heaters supplied with reduced pressure steam are installed where freezing could occur if traps failed to open. In this case select traps that will open at maximum steam supply pressure and still have adequate capacity at reduced pressure.

FREE ON REQUEST—COMPLETE INFORMATION on the above points, diagrams, selection data, tables and additional recommendations are contained in Armstrong Bulletin No. 252. Also includes BTU output ratings for all models of 30 makes of unit heaters. Call your local Armstrong Factory Representative or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

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880 Series, integral strainer.

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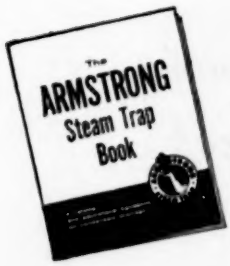

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

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AIR CONDITIONING HEATING AND VENTILATING

Volume 57, Number 8 **August, 1960**

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AIR HANDLING
Chart Speeds Orifice Sizing 57
Chart plus step-by-step procedure is easily followed. . . . . R. Brief

AIR CONDITIONING
Handling Fan Heat Loads at Minimum Cost 61
Pros and Cons of higher temperature differentials weighed. . . . . S. Daryanani

ACOUSTICS
Practical Selection of Sound Control Treatment 63
How to specify sound control for duct systems. . . . . J. W. Overend

DESIGN PRACTICE
Industrial Building Operators' Problems 67
What the design engineer should know of owners' viewpoint. . . . J. Vonderheid

AIR CONDITIONING
Reference Section—Design of Pneumatic Control Centers 69
Basic components explained; typical installation laid out. . . . . R. J. Caffrey

AIR CONDITIONING
Special Report—Evaluation of School Air Conditioning 77
Three viewpoints presented at seminar.

DRAINAGE
Data Sheet—Flow of Water in Circular Sewers (Concluded) 85
Time-savers for sizing drainage piping. . . . . J. Nachbar

Data Sheet—Wheel Load Transmitted to Buried Pipe 86
How to determine minimum crushing strength for pipe under roads.

HEATING
Detail Sheet—Gas-fired Unit Heaters 87
Installation details and wiring diagrams.

AIR CONDITIONING AND VENTILATING
How Much Air Is Delivered? 89
Part 5—All you need to know about field testing fans. . . . . C. J. Trickler

HEATING
District Steam Industry Expands—Part 1 94
Abstracts of papers presented at NDHA Convention. . . . . A. F. Metzger

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DEPARTMENTS

High Spots in this Issue 4
News of the Month 6
Picture Paragraphs 76
Applications and Installations 96
Plumbing and Piping—L. Blendermann 100
Degree-Days for June, 1960 . . 104
New Literature 106
New Equipment and Materials 111
Briefly Stated News Items . . 140
Coming Events 146
What Readers Say 148
Index to Advertisers 150
Ad-Digest 153

COVER PHOTO: The future progress of education, whether viewed from the standpoint of pupil, teacher, school plant or learning environment, **will require air conditioned schools.** This is the substance of a school symposium sponsored recently by Carrier Corporation and conducted by professionals active in one phase or another of educational activity. A **Special Report,** beginning on page 77, contains condensations of three talks, representing teacher, superintendent, and architect-engineer viewpoints, presented at this symposium.

HIGH SPOTS in this issue

PNEUMATIC CONTROLS: After the air conditioning engineer has mastered the several disciplines that constitute his art, there remains the subject of controls, a specialty in itself. The great breadth of the subject, the variety of applications, and the competing claims of rival systems are often productive of more heat than light. Mr. Caffrey's treatment of **pneumatic control and control centers** in this month's **Reference Section,** starting on page 69, is all the more welcome for its brevity, clarity, and frankness.

ORIFICE CHART: **Sizing an orifice** for metering the flow of air, gas, or liquid has been reduced to a relatively few steps in a straightforward method that centers around a new chart. See page 57.

HIGH VELOCITY AIR CONDITIONING: The higher the system pressure, the more **fan horsepower becomes a factor** in cooling load calculations. What is the best way to handle this new and growing tax on the air conditioning dollar? A design engineer offers several alternatives on page 61.

SOUND CONTROL: Present methods of design calculation in octave frequency bands for **selection of noise suppression equipment** are not so accurate that they cannot be greatly simplified without undue risk. Here's how to simplify calculations safely. Page 63.

THE OWNER SPEAKS: **Engineers may profit** from the expert point of view of a fellow professional who has lived with and modified facilities designed for one of the nation's outstanding industrial establishments, Appliance Park. See page 67.

TWO STORIES IN ONE: The lead story in **Applications and Installations** this month tells about the application of a new type of fan and a clever control arrangement for supply air in solving the problems of very limited space and shifting loads in **air conditioning a computer room** for The Travelers Insurance Company in Hartford, Conn. Last month, in this department, one method of handling computer heat was presented. Here is another way. Page 96.

The First National City Bank of New York

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NEWS OF THE MONTH

USE DOMESTIC WATER HEATER TO SUPPLEMENT HEAT PUMP?

A suggestion that the oil-fired domestic water heater be teamed with the electric heat pump was made by Richard C. Wright, engineering vice-president of Iron Fireman Mfg. Co., Cleveland, Ohio.

Fuel-Fired Heater to Stay

Mr. Wright noted three factors that make this plan possible: (1) The heat pump cannot supply water at the temperatures needed for domestic hot water. (2) The electric hot water heater costs three times as much to operate as the oil-fired heater. (3) The heat pump is economically feasible only when used for summer cooling and winter heating, but becomes quite expensive in more northerly sections where the outside temperatures become quite low and the heating season is long.

"Let the heat pump do the summer cooling job and mild weather heating where it is efficient," Mr. Wright said, "Then take over the real heating job with an attachment on the water heater."

Utility Promotion Is Paying Off As Electric Heating Load Grows

New statistics on the electric heating industry, issued by the Business and Defense Services Administration, U. S. Department of Commerce, reveal a growing importance of electricity in the heating field, previously dominated by gas and oil.

The market potential for use of electricity as a heat-producing medium has long been recognized, it was stated in the July *Construction Review*, and promotional effort by electric utilities and others is apparently producing results, especially in the market for residential heating systems. Historically, warm air furnace equipment and wet heat, or hydronic systems have dominated this field. Electric heat, is, of course, adaptable to warm air and hydronic systems.

The annual volume of heat-producing equipment manufactured for habitable structures is approximately $387 million, including electric heat, warm-air furnaces, and steel and cast iron heating boilers. Of this total, approximately 46% use gas as a heat source; 42% oil; 7% electricity; and 5% solid fuel.

Of the manufacturers contacted in the Business and Defense Services Administration survey, 13 stated that they did not manufacture electric heating equipment in 1959 but that production was contemplated in 1960 or soon thereafter. There is every indication that the use of electricity as a fuel for all types of space heating is receiving careful attention from the entire heating equipment manufacturing industry.

Shipments

Shipments by 558 manufacturers are included in the reported total of $27,834,294 in 1959. Analysis of this total, by type of equipment, is as follows:

	Output, Thousands of Btu/Hr	*Percent Dollar Value*
Baseboard (not including glass panels)	9,571,986	29.9
Convectors:		
Without fan	1,618,280	20.1
With fan	1,138,839	15.3
Glass panels:		
Baseboard	590,819	2.4
Radiant	234,101	5.1
Unit heaters and unit ventilators	666,601	20.3
Warm air furnaces:		
Central	54,660	0.3
Floor	21,807	0.2
Wall	66,760	0.8
Cable systems fabricated as:		
Units	589,239	3.9
Cable only	85,520	1.7
Total	14,638,612	100.0

Shipments of electric baseboard radiation equipment accounted for nearly 30% of total shipments, apparently following the upward trend of baseboard radiation utilized in the wet-heat systems. Convector type radiation and baseboard radiation together accounted for slightly more than 65% of total

(Continued on page 138)

SUBWAY CAR AIR CIRCULATION PEGGED TO CAR TEMPERATURE

The new-type ventilating units give stainless steel subway-elevated cars in Philadelphia a distinctive roof-line. The lightest and most economical ever designed for transit cars, units provide unexcelled efficiency and comfort for passengers, states The Budd Company, manufacturers of the cars.

Four of the ventilator units are mounted in the car roof, each composed of a hooded, weather-tight fresh air intake; a pneumatically operated damper; a plenum chamber where fresh and recirculated air is mixed; a 23-inch, high-pressure fan; and a diffuser mounted in the car ceiling. The system is thermostatically controlled and begins operating at 65 deg F. At this

stage the dampers open and the fans begin moving about 500 cfm. Fan speed increases automatically as temperature rises up to a maximum of 87 deg, when each fan is bringing in 3000 cfm and the air in the car is being changed four times a minute.

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COMPLETE LINE OF STEAM TRAPS

Hoffman Traps are specially designed and constructed to give economical removal of condensate from steam lines, long in-use life, and easy access for servicing. Traps illustrated are typical of Hoffman's complete line; each has removable cover, pin and seat for quick inspection and cleaning.

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50 Series Float and Thermostatic Trap for Steam Systems and Equipment. For quick access and ease of servicing, all working parts of Hoffman Float and Thermostatic Traps are attached to trap's removable cover. Once installed, cleaning and repairing is possible without breaking pipe connections.

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50 Series F & T Traps feature quick access to all working parts . . . low maintenance costs.

600 Series Bucket Traps feature straight-through pipe connections and changeable valve seats and pins.

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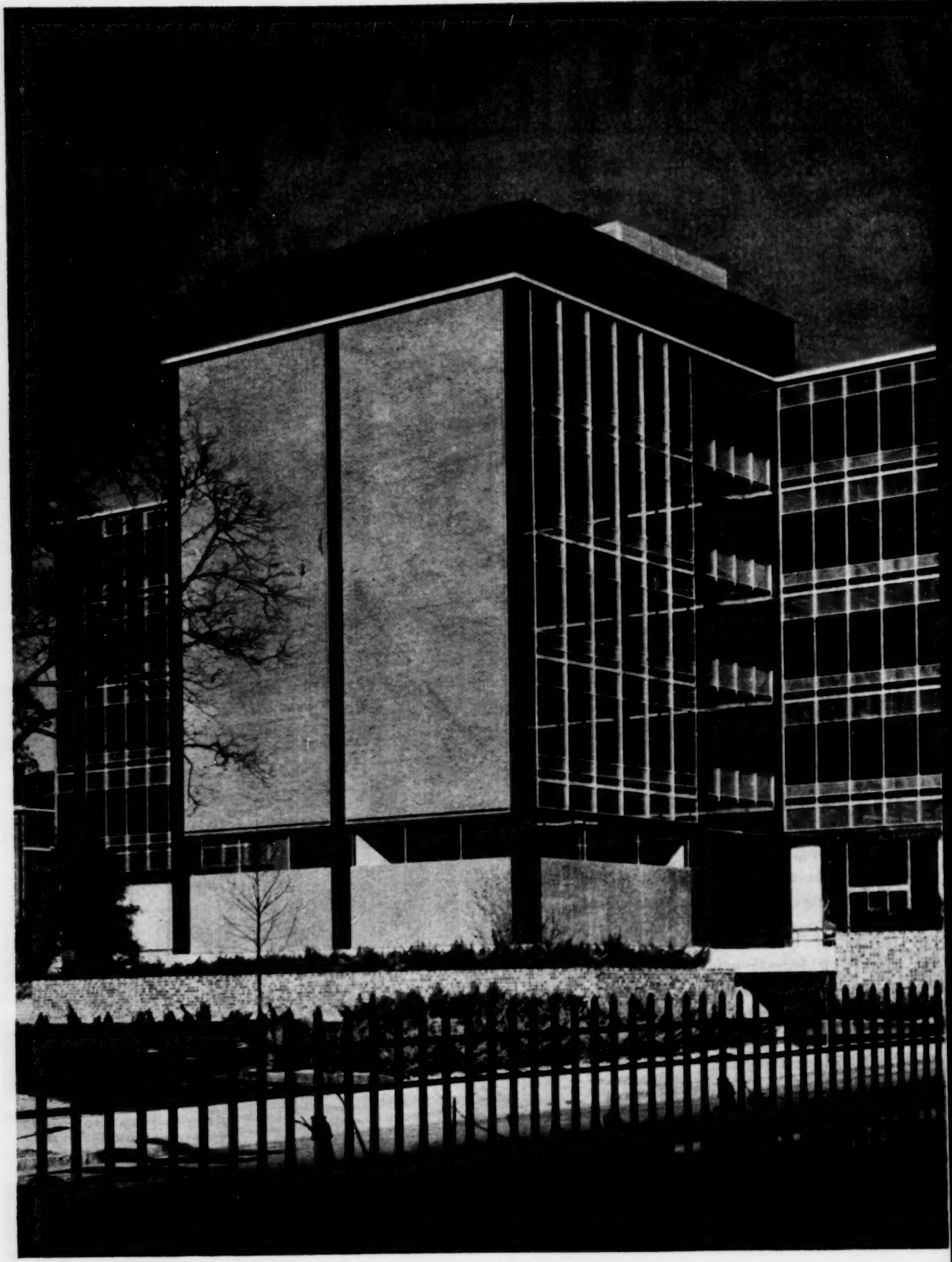
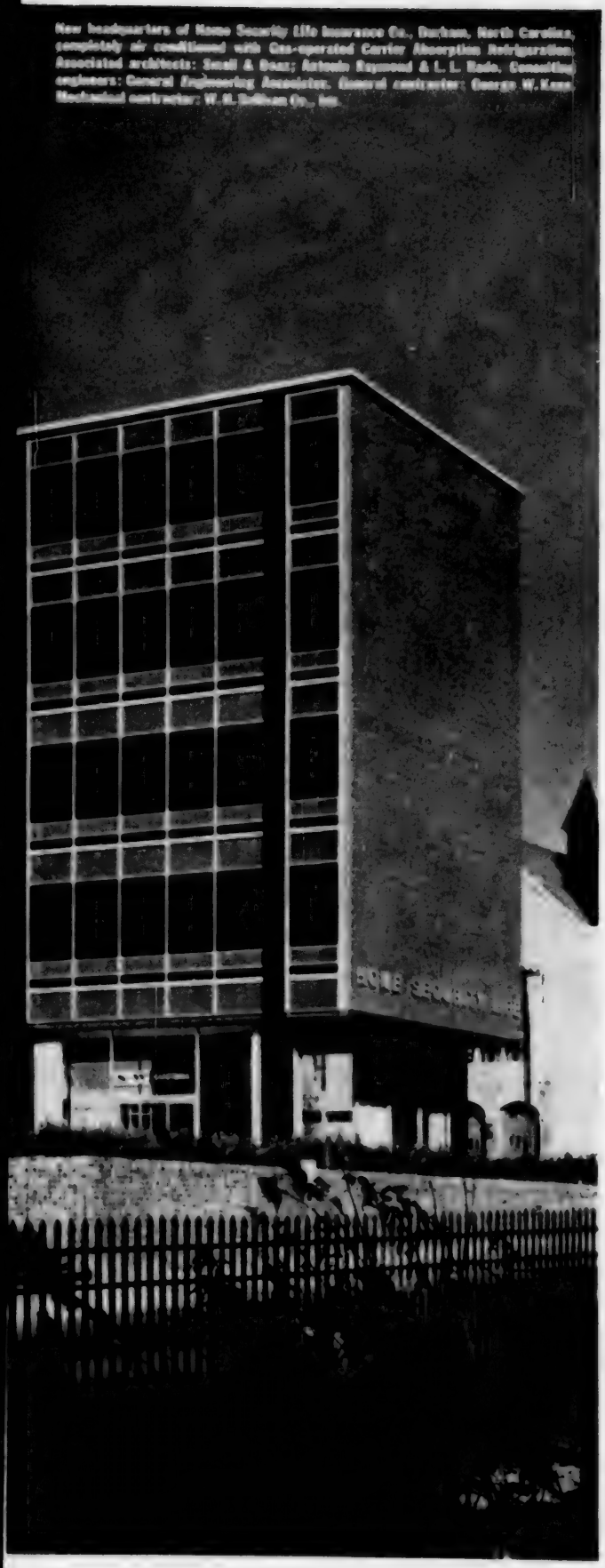




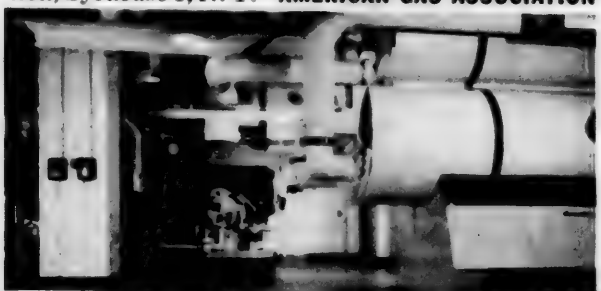
New headquarters of Home Security Life Insurance Co., Durham, North Carolina, completely air conditioned with Gas-operated Carrier Absorption Refrigeration. Associated architects: Small & Dean; Antonin Raymond & L. L. Bade. Consulting engineers: General Engineering Associates. General contractor: George W. Kane. Mechanical contractor: W. H. Sullivan Co., Inc.

Insurance company insures comfort cooling with GAS-operated CARRIER Absorption Refrigeration

The attractive new home office of Home Security Life Insurance Company in Durham, North Carolina, is as modern in personnel comfort as in its design. It is completely air conditioned with one of the most efficient systems available – Gas-operated Carrier Absorption Refrigeration serving 190 Modular Weathermaster* room units.

The Carrier absorption system is the essence of simplicity and economy. No prime mover is required. The energy source is low-pressure steam from a gas-fired boiler. Water is the cooling agent. Boiler capacity is put to use on a year 'round basis ... cooling in summer, heating in winter. And thrifty gas keeps fuel costs low.

For comfort cooling at low cost, specify Gas and Carrier Absorption Refrigeration. Performance data and cost details are yours for the asking. Call your local gas company, or write Carrier Corporation, Syracuse 1, N. Y. **AMERICAN GAS ASSOCIATION**



Good-looking machine room. Reflects up-to-date design of entire building. Here the gas-operated Carrier unit operates at 250-ton capacity to cool 575 GPM water from 52.5 F to 42 F, when supplied with 12 psig steam. *Reg. U. S. Pat. Off.

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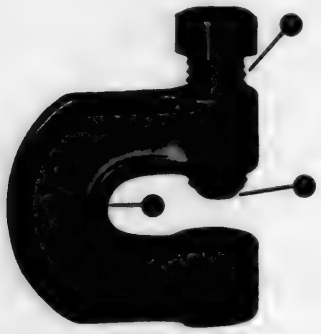
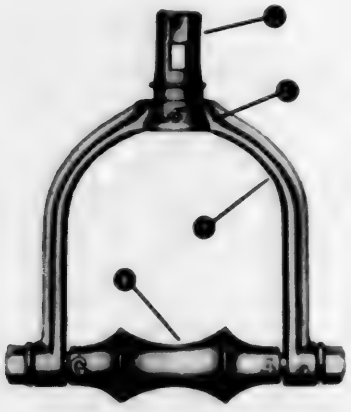
Look at all the extras you get in Grinnell Pipe Hangers . . . yet you pay no more!



GRINNELL C-CLAMP, FIG. 88 — 1 Ribbed, malleable iron casting, for extra strength 2 Hardened steel, cup-point set screw for good "grip" on beam 3 Full thread engagement – casting is drilled and tapped for rod and set screw

GRINNELL EXTENSION SPLIT RING, FIG. 138 — 1 Nipple engaging thick section of malleable iron gives rigidity for support from above, below or from wall 2 Tapped to take screw. No nut to lose 3 Special ring contour holds pipe or tubing firmly



GRINNELL ADJUSTABLE SWIVEL PIPE ROLL, FIG. 174 — 1 Swivel shank permits adjustment without elaborate support 2 Locking device prevents accidental adjustment change; no lock nut required 3 Ribbed design in malleable iron for better strength, lightness, appearance 4 Easy installation; maximum adjustment

GRINNELL CB CONCRETE INSERT, FIG. 282 — 1 One body size accommodates several sizes of rods 2 Slot takes reinforcing rods to assure maximum load rating 3 One-piece body prevents concrete seepage 4 Teeth on insert and nut hold rod firmly in place 5 Homogeneous composition of malleable iron throughout

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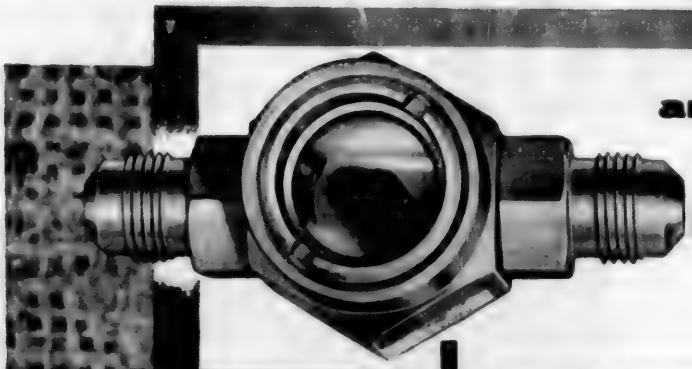

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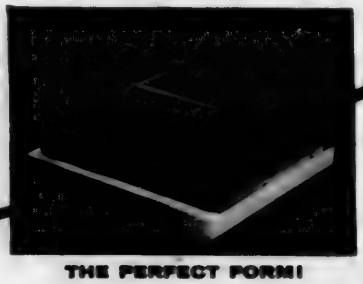
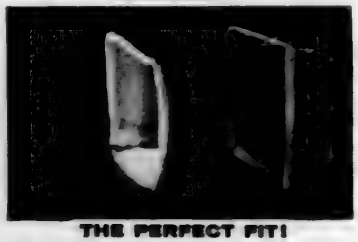


THE PERFECT FORM!

Basic component is a low density, three-dimensional batt, sewed into cube shape. Rust-proof retainer frame is inserted in batt, then batt is inserted in wire retaining basket. Final three-piece assembly is supported by holding frame within unit, is easy to handle—no sharp edges or "splinters". Easy to dispose of when full—simply collapse and discard . . . the dust is in the bag!



THE PERFECT FIT!

Shape of retainer frame inside batt permits filter to seal itself in holding frame. Final filter assembly is a tight, leak-proof, press fit.

Type Air Filter:

New Filter Medium!

DYNEL filter medium stops and holds unusually large quantities of dirt. Self-sealing, leak-proof assembly completely eliminates problem of filter bypass . . . provides maximum economy at highly acceptable filtration levels.

Saves Change-Over Dollars!

ULOK Cube Filter lasts 6 times longer. Dirt is first trapped on inside face of filter. As dirt builds up, air flow is shunted to large filtering area of four sides. Thus, even after several *pounds* of dirt have been collected, high filtering efficiency and low pressure drop is maintained. This "reverse loading" process increases service life *6 times* over that of conventional filters. Think of the savings in maintenance!

Uses Half The Space!

Medium-size ULOK Cube Filter has a filtering surface of 1040 sq. in.—140 more than a conventional 30″ x 30″ flat filter—yet it presents a frontal area of only 20″ x 20″. Filter bank area can thus be reduced by *half* with medium-depth filter, *even more* with deeper models.

At All Velocities!

ULOK Cube Type Air Filters afford the high filtering efficiency characteristic of low velocity units even in units employing air volumes as high as 1970 cfm!

Proved In Operation!

ULOK Cube Type Air Filters have been soundly proved in numerous installations. Reflecting a complete range of the filtering problems presented under varying operating conditions, these field trials were complemented by extensive and extremely severe laboratory tests.

Ideal for all commercial and industrial air conditioning, heating, and ventilating systems, ULOK Cube Type Air Filters are available in 12 sizes to meet any requirement.

WRITE TODAY FOR FURTHER INFORMATION AND PRICES.

UNION CARBIDE ULOK BRAND

UNION CARBIDE DEVELOPMENT COMPANY

Division of Union Carbide Corporation

270 Park Avenue • New York 17, N.Y.

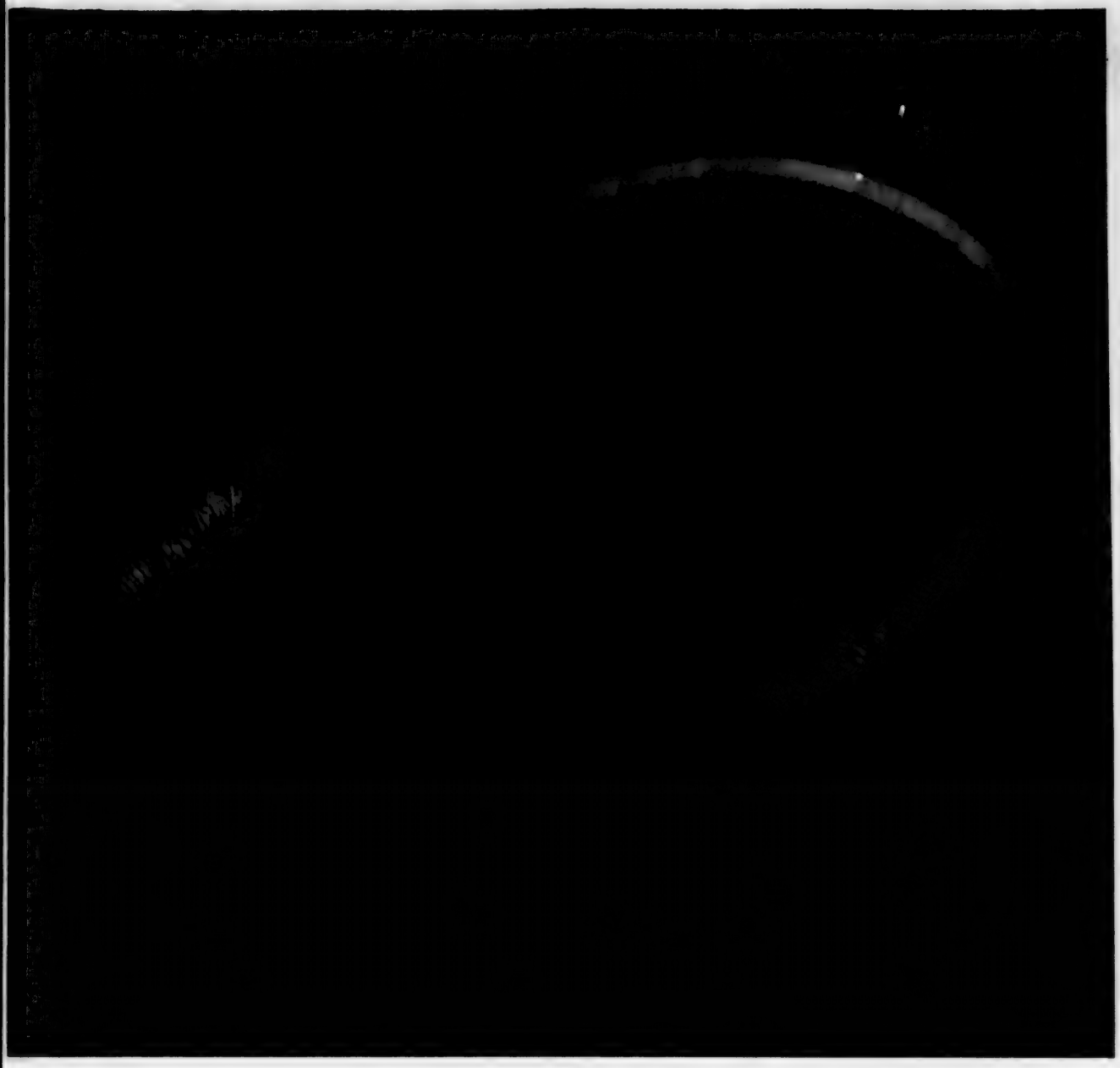
ULOK and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Stop pipe condensation with the built-in vapor barrier of J-M Aerotube

...THE FLEXIBLE, FOAMED PLASTIC PIPE INSULATION THAT CUTS INSTALLATION COSTS IN HALF.

For heating, plumbing and air-conditioning service—wherever sweating or condensation is a problem—Johns-Manville Aerotube® is the economical solution.

Aerotube is a tubular pipe insulation for use at temperatures from 32F to 220F (double layer of Aerotube permits range of 0F to 220F). Its closed cell structure stops the passage of moisture. This built-in vapor barrier, plus the insulating effectiveness of Aerotube, will prevent condensation under normal design conditions on indoor lines. What's more, you



can depend upon Aerotube to maintain its effectiveness indefinitely.

Aerotube is the easiest-to-install pipe insulation available today. On a straight run of pipe or the most complex bend, Aerotube's six-foot lengths go on quickly. For connected pipe, just slit Aerotube longitudinally, snap it on, and seal it up! You'll discover that labor costs are substantially reduced when Aerotube is chosen to solve condensation problems.

Available in a wide range of thicknesses, there's an Aerotube insulation that meets your particular needs. For full information, send for brochure IN-213A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

Even the most complex bend is easy to insulate with flexible J-M Aerotube.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

SOFTITE® BY WHEELING

...bend it

...hem it

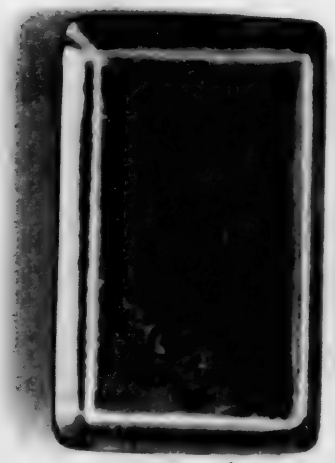
...scribe it

...punch it

...form it

...notch it

...lock it ...snip it



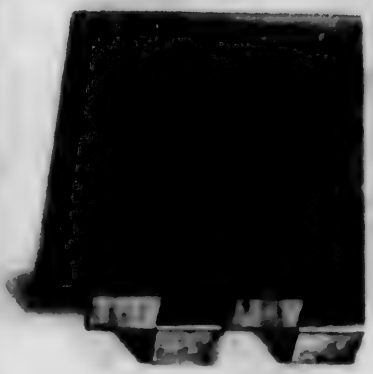
...draw it

...saw it

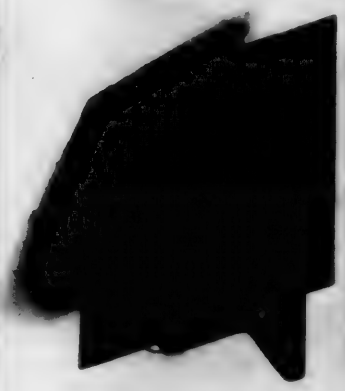
...stamp it

...shear it

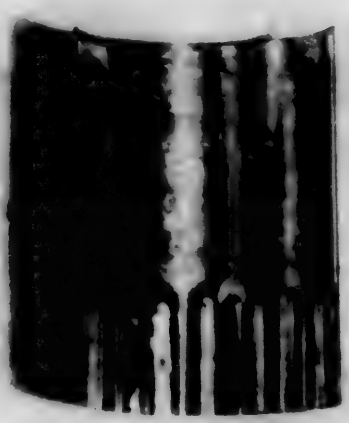
...seam it



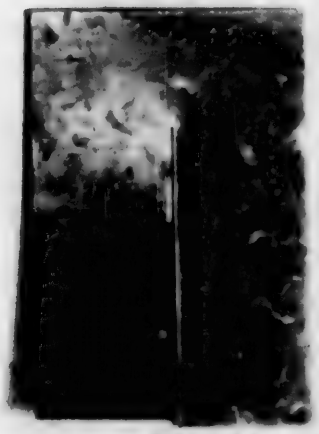
...dovetail it



...weld it



...crimp it



...slit it

...wire it

OUR CHALLENGE STANDS!

"Anything that can be made of steel sheets can be made of Wheeling SOFTITE® galvanized steel sheets!"

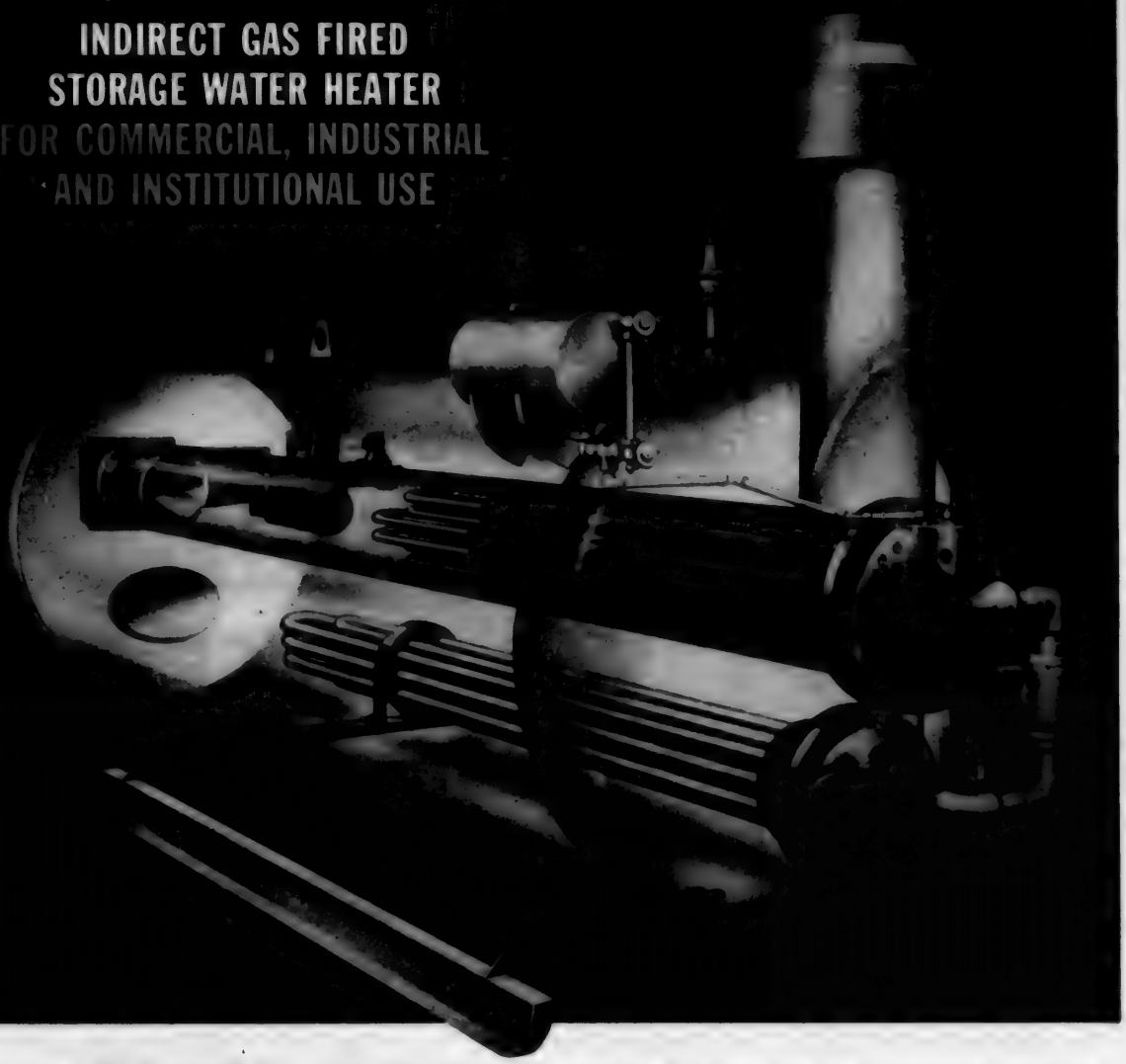
WHEELING STEEL CORPORATION • IT'S WHEELING STEEL!

District Sales Offices located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling

Steel

FIRST

INDIRECT GAS FIRED STORAGE WATER HEATER FOR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL USE



No scaling • No drop-off in rated efficiency • No fuel waste • No on-the-job assembly • No complicated maintenance • No limitations on placement • Fully automatic • Copper heating surface

P-K SCALEFREE 230* is a unique rugged unit backed by P-K's 80 years of experience in building and designing quality water heating equipment. It heats water through hot intermediate distilled water. Transfer occurs below the temperature at which minerals that cause scaling precipitate. Efficiency remains unimpaired throughout service life. Linings of pre-Krete or copper are available to keep the unit free of rust and corrosion regardless of water conditions.

SCALEFREE 230 features a new P-K gas burner. It operates at maximum practical efficiency. Yet it gives almost noiseless service—does not rumble or boom on startup. This permits location almost anywhere in office buildings, institutions, schools, motels, etc.

SCALEFREE 230 is a complete fully automatic package that can be quickly set in place, hooked up and checked out. It is available in more than 100 storage and recovery combinations. Storage capacities range from 250 to 4000 gallons. Recovery sections range from 390,000 to 2,215,000 Btu. Write for catalog with full information.

*Patent pending

Patterson Kelley

101 Morgan Avenue, East Stroudsburg, Pa.

NEW DUAL DUCT SYSTEM WITH OLD RADIATION

DUAL DUCT COMPATIBILITY

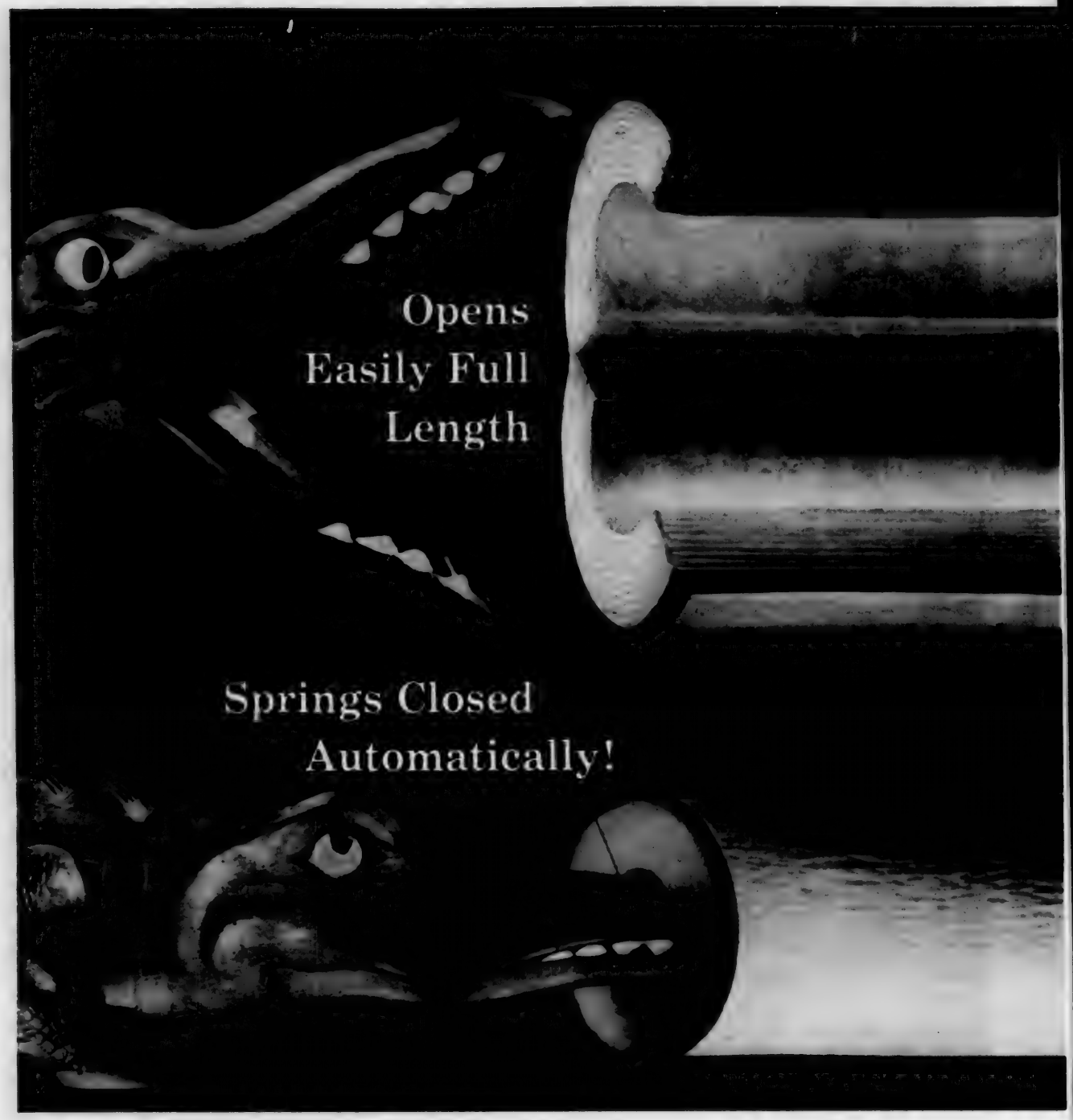
Adding air conditioning to an existing building need not be a weighty problem. The radiation system generally inherent to this type of structure can simply and economically be augmented by Buensod Dual Duct. Dual Duct is 100% compatible with existing systems. Zones supplied by the old system are given additive ventilation as required and are cooled in warm weather. Newly created zones are completely conditioned for year-'round comfort.

The Dual Duct system is basically a simple one. Hot and cold air is carried at high velocity in separate ducts. Buensod air mixing units in the various zones quietly deliver just the right amount of conditioned air. And exclusive Authomatic Volume Control maintains constant air volume regardless of static pressure variation so the system can never be thrown out of balance. Specify Buensod for your next renovation and see how Dual Duct compatibility simplifies your job.

BUENSOD DUAL DUCT

BUENSOD-STACEY CORP., 46 West 10th Street, New York 11, N. Y.

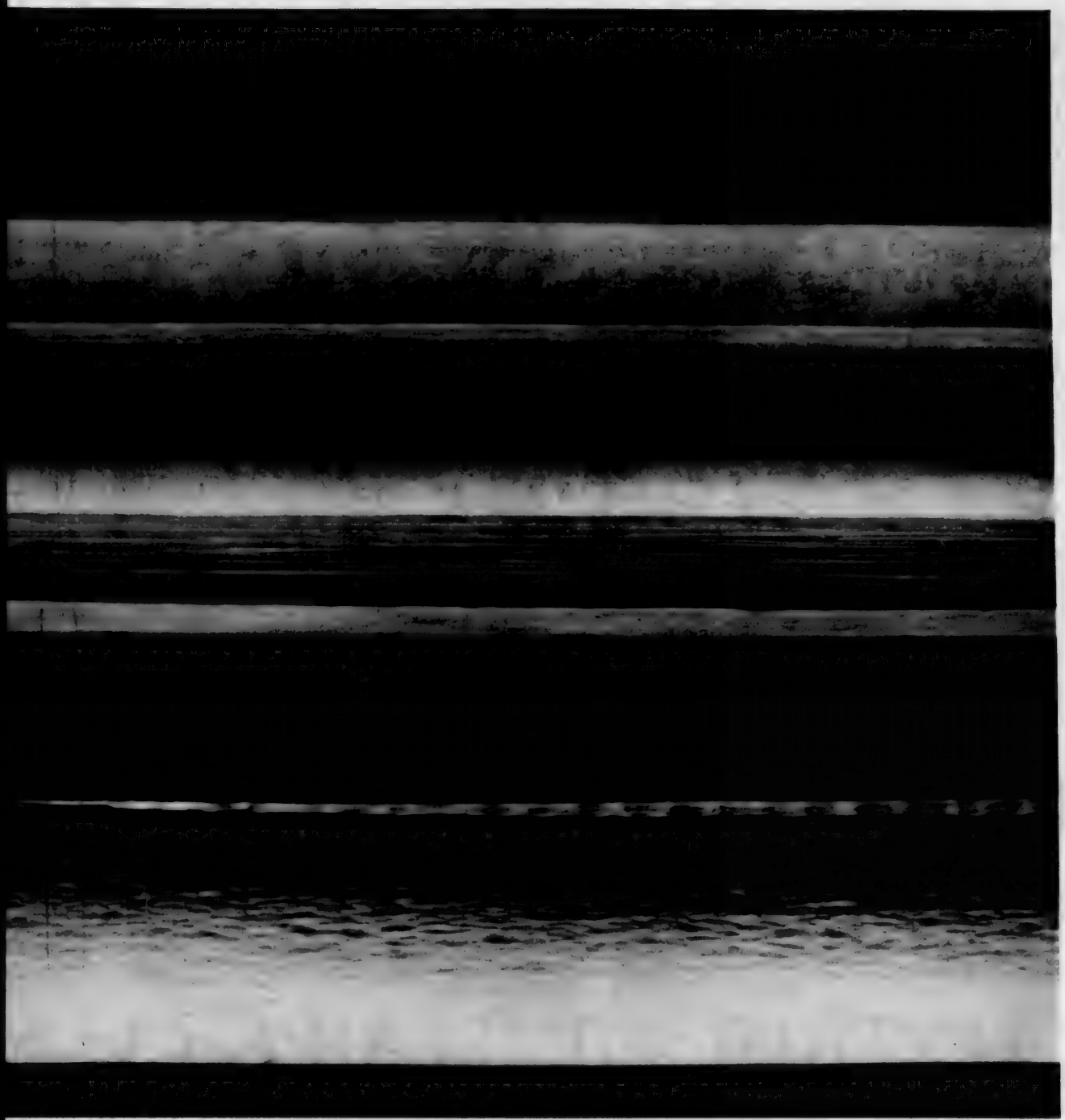
A subsidiary of Aeronca Manufacturing Corporation



Only J-M MICRO-LOK Fiber Glass Pipe Insulation Provides The Exclusive "Spring Hinge" Action!

Exceptional fiber resiliency and fiber alignment are the secret of Micro-Lok's easy-to-open, fast-to-close action. Only Johns-Manville Micro-Lok goes on so effortlessly, makes proper application so easy.

Micro-Lok has a remarkably low *k* factor which means lower fuel and power costs . . . gives hot or cold line protection from minus 120F to 370F above. The glass fibers in Micro-Lok do not absorb moisture . . . will not rot, shrink or swell.



Outside surface is smooth . . . has a neat appearance. It comes in a choice of factory-applied canvas, regular and flame-resistant vapor-barrier jackets. Available for all pipe and copper tubing sizes in standard thicknesses.

Contractors like the way Micro-Lok saves them job hours. It's featherlight, yet resilent enough to take rough handling. Drop it, bang it—no damage! Accurate inside diameter assures snug fit, and Micro-Lok is easily cut to fit joints, hangers or other irregularities.

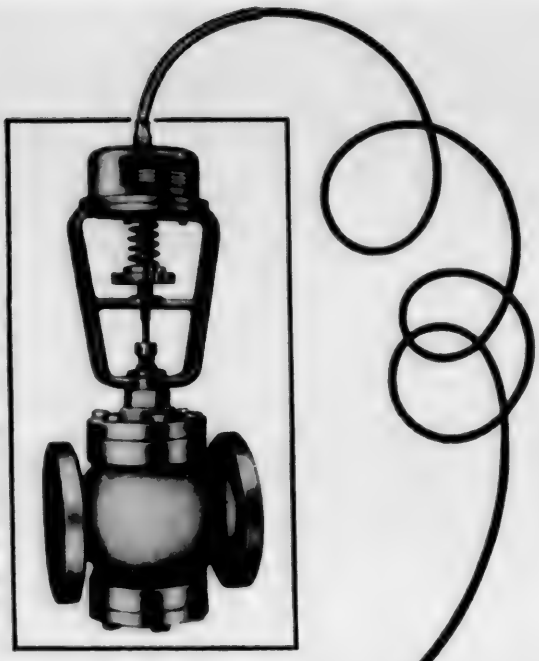
Complete information from the nearby J-M Representative. Or write to Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ont.

JOHNS-MANVILLE FIBER GLASS

LAWLER TYPE "S" TEMPERATURE REGULATOR ... UNEQUALLED ACCURACY IN TEMPERATURE CONTROL FOR INDUSTRY'S MOST EXACTING REQUIREMENTS.

High sensitivity . . . rugged performance are combined in the Type "S" by Lawler's advanced engineering design to meet modern thermostatic control needs in processing, dairies, refineries, chemical plants, maritime services, diesel engineering, wherever steam, gases or fluids are used.

The Type "S" goes into action instantly on demand, maintaining the desired temperature. As with all Lawler Line valves, the Type "S" is your mark of performance quality . . . precision control of temperatures.



LAWLER LEADERSHIP WHEREVER PRECISION CONTROL OF TEMPERATURES COUNTS! ··· LOOK TO LAWLER ····· FIRST!

LAWLER AUTOMATIC CONTROLS, INC. MT. VERNON, NEW YORK

NEW ILG "UB" Ventilators blast up to 33,300 CFM

In Balance. Ilg-built fan wheels pass rigid dynamic balancing tests before being direct-connected to Ilg-built 3-phase or permanent-split capacitor 1-phase motors.

Five Fan Sizes. Airfoil-design blades are available in five sizes: 24, 30, 36, 42 and 48 inches. Sizes from 24 through 36 inches have steel blades; sizes 42 and 48 inches are aluminum.

Mount a new Ilg Type UB "Upblast" Ventilator directly over a roof opening and you get high-speed, vertical exhaust from either duct or open areas. Airfoil-design propeller blades are direct-connected to Ilg-built totally enclosed motors for vibration-free operation.

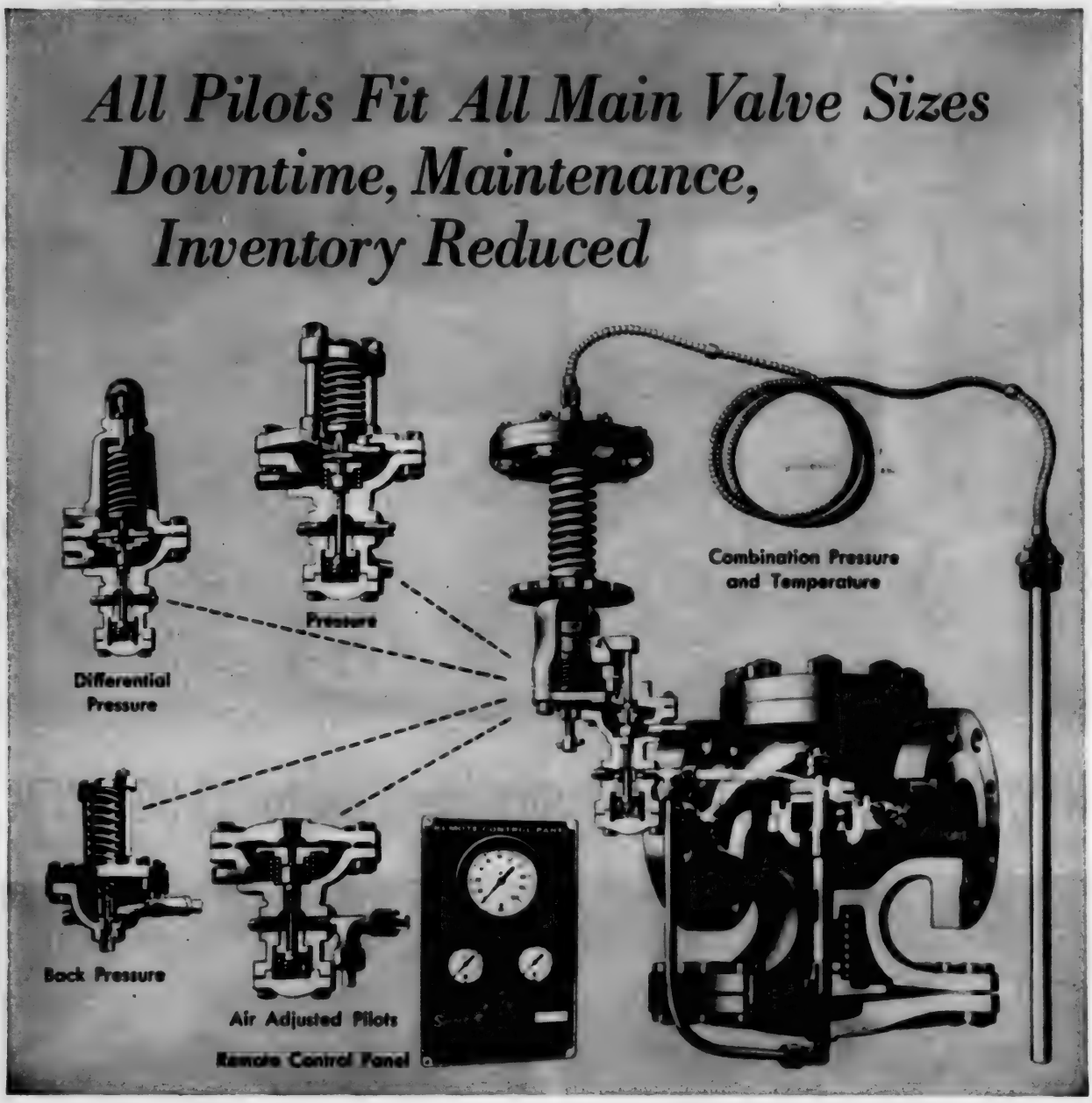
Sturdy steel housing . . . weather-tight steel frame . . . gravity-type butterfly damper provide all-weather protection. Five fan-wheel sizes: 24, 30, 36, 42 and 48 inches; capacities from 5060 to 33,300 cfm. WRITE FOR BULLETIN 4809.

ILG

ILG ELECTRIC VENTILATING CO.

2851 No. Pulaski Road, Chicago 41, Ill.
Offices in 80 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

All Pilots Fit All Main Valve Sizes Downtime, Maintenance, Inventory Reduced



Let's start off by admitting there's no such thing as a "maintenance-free" regulating valve. Any valve that automatically controls temperatures or pressures within close limits can be affected by dirt in steam lines.

If trouble does develop, engineers want a regulator they can get back on the line — fast. That's one reason why more engineers are standardizing on Spence Regulating Valves with externally mounted pilots. The simple test of disconnecting the external bends establishes whether the trouble is in the main valve or the pilot.

If the main valve is the trouble spot, it can be maintained without removing the valve body from the line. If the pilot is the trouble spot, it is easily removed for cleaning. However, if production downtime is a strong factor, the fastest method is to install a spare pilot and it is inexpensive.

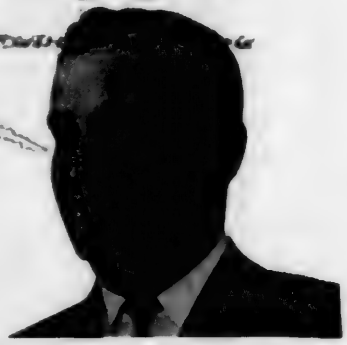
All Spence pilots fit all sizes of Spence main valves. If you have twenty pressure regulators, for instance, all you need is *one spare pilot*. It will fit all main valve sizes from ¼" to 12".

Another advantage of the Spence design is the external pilot is interchangeable. You can change the function of a regulator by merely changing the pilot. In many plants this can represent an important factor in reduced inventory costs because you only carry a few inexpensive extra pilots instead of complete regulators. Obviously, there is also a considerable savings in labor costs when a valve can be converted, in the line, from a temperature regulator to any one of various pressure regulators.

The pictures above show a few of Spence's wide line of automatic regulators. For more information write for Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York 8S-160

"Because of the many savings made possible by using COPPER DWV we were able to do these two school jobs for the same price as rustable pipe,"



Says Clarence Wiedenbeck, *President*
CLARENCE WIEDENBECK CO., INC.
Buffalo, N. Y.

THE CLOVERBANK ELEMENTARY SCHOOL at Wanakah, N.Y., and the **BLASDELL ELEMENTARY SCHOOL**, Blasdell, N. Y., are identical in design and construction. Total amount of Revere Copper Tube used in these schools was 11,060 feet for plumbing and DWV lines, in sizes from ½" to 4"

Architect: EARL MARTIN, Buffalo, N. Y.
Engineers: BEMAN & STANDEVEN, Buffalo, N. Y.
Gen. Cont.: ALBERT ELIA BUILDING CO., INC., Niagara Falls, N.Y.
Revere Dist.: HARBRO PLUMBING SUPPLY CORP., Buffalo, N.Y.

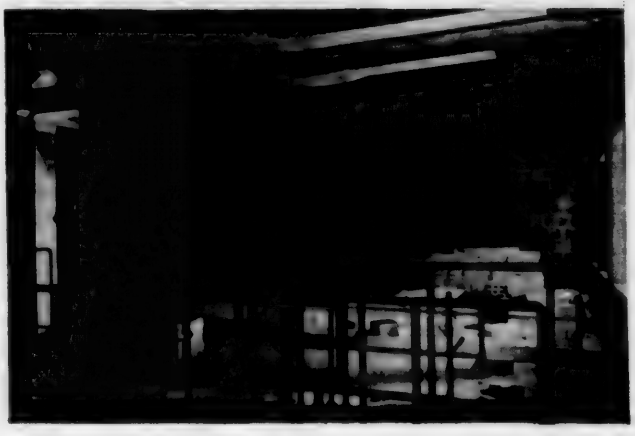
"The original 'specs' called for drainage lines of galvanized wrought iron and cast iron. When we told the Architect we could give him a quality job for the same price, the 'specs' were changed.

"One look at the pictures shown here and you can see why we can turn out a quality copper job for the price of rustable pipe. Just figure the time to make all those joints, thread the pipe and swing a wrench. It's much simpler and easier handling when you can use solder fittings. And there's less chance of leaks, too.

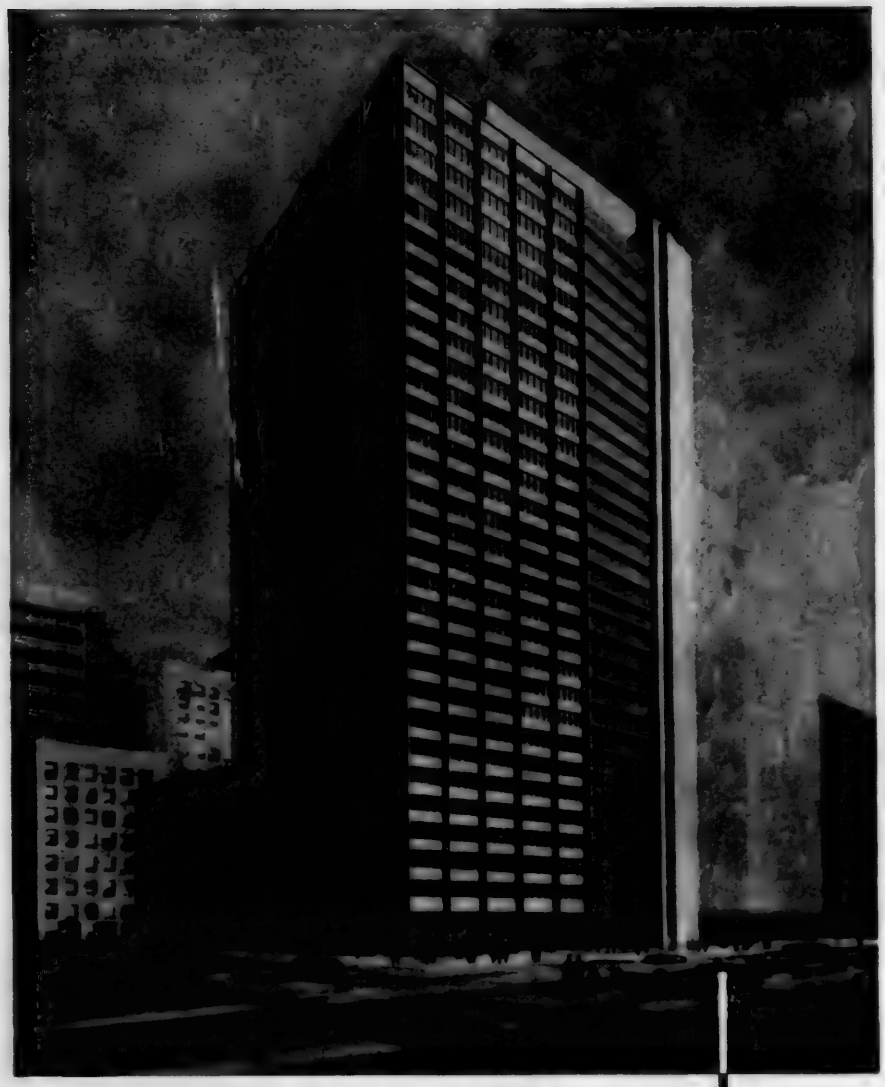
"And when you get into the 3" and 4" sizes one man can handle the 20' lengths of copper tube with ease. It's when you make the long runs like that shown at ceiling line in lower photo at right that copper *really* shines. With cast iron this would be a two-man job. Another saving, when you use copper, is that you can set up your 'trees' either in the shop or on the job," concluded Mr. Wiedenbeck.

Why don't *you* follow the trend to 100% copper plumbing? It's a good lever to pry loose the close-figured jobs. At the same time, you earn the reputation for quality installations.

See the Revere Distributor for Copper Water Tube that bears the oldest name in copper . . . Revere.



REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.
Mills: Rome, N. Y.; Baltimore, Md.; Chicago, and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.



MAYFLOWER BUILDING
DALLAS

Owner:
Mayflower Investment Company
Dallas
Architect-Engineer:
Wyatt C. Hedrick — Dallas
General Contractor:
Inge & Hayman, Inc. — Dallas
Air Conditioning Contractor:
Straus Frank Company
Dallas and Houston

IN THE MAYFLOWER INVESTMENT COMPANY BUILDING—IT'S AGITAIR®

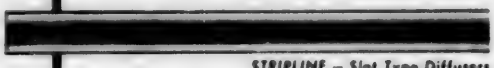
for better air

It's results that count...that's why more and more architects and engineers are writing AGITAIR into their specifications and that is why you will find AGITAIR now installed in leading buildings. Millions of AGITAIR products are today providing correct air handling on thousands of applications in all kinds of commercial and industrial business.

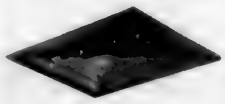
AGITAIR provides an extensive line of high velocity mixing boxes...air diffusers...registers...grilles...filters...and exhausters. To assist you in selecting and sizing the AGITAIR best suited for your job condition, Air Devices Inc. has available a complete library of engineering data.

Ask your local AGITAIR representative or write to Air Devices Inc. for technical information on any of these products.

Circular Diffusers



STRIPLINE — Slot Type Diffusers

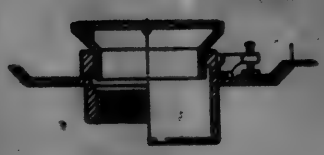
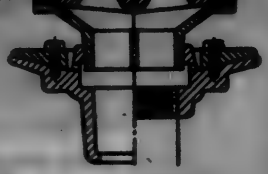


Square and Rectangular Diffusers

high velocity units • air diffusers
registers and grilles • filters • exhausters

AIR DEVICES INC.
185 MADISON AVENUE, NEW YORK 16, N.Y.

Design Comparison:

THE BASIC FLOOR DRAIN*	WADE	 BRAND "J"	 BRAND "Z"
Weight	[illegible] LBS.	11 LBS.	12 LBS.
Body Tapping for Strainer	[illegible] Standard Pipe Thread	3½" Special Thread	3½" Standard Pipe Thread
Method of Tightening Clamping Device	[illegible] Hex Head Bolts	3 Die-Cast Clamping Lugs with Cadmium Plated Steel Round Head Machine Screws.	4 Corrosion Resistant Hex Head Bolts.
Weep Holes	[illegible]	Three 5/16" Dia. Holes	Four 3/8" x 1/8" Slots
Total Seepage Opening	[illegible]	.23 Sq. In.	.31 Sq. In.
Surface Area of Seepage Flange	[illegible]	44.21 Sq. In.	49.48 Sq. In.
Bearing Surfaces of Clamping Device	[illegible]	15.48 Sq. In.	42.43 Sq. In.

*The basic floor drain type, specified and used more frequently than any other type.

"So that's why we can't say **Wade or equal** eh chief?"

"Right! **Wade has no equal!**"

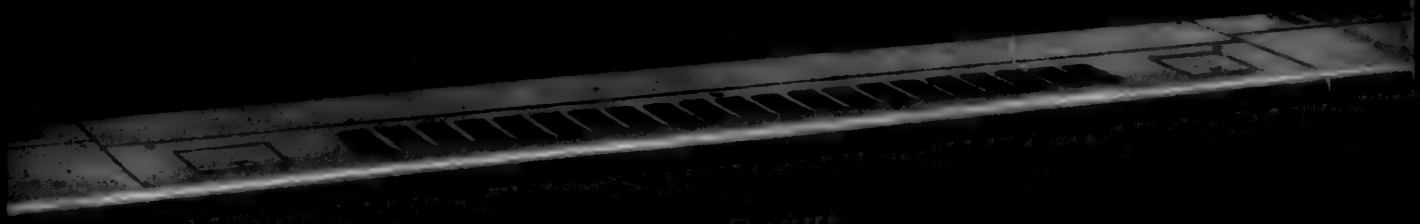
NOTE: Drain comparison data based on manufacturers' published literature and on product samples purchased on the market.

WADE

WADE MANUFACTURING COMPANY
ELGIN, ILLINOIS

Introducing the new

WEBSTER UNIT VENTILATOR



for Complete Comfort Control with WEBSTER SYSTEM FOR SCHOOLS

A WEBSTER UNIT VENTILATES AS IT HEATS OR COOLS FOR COMPLETE CLASSROOM COMFORT

Simply heating today's classroom is not enough. Adequate ventilation and cooling are equally vital in providing a comfortable environment in which to teach and learn. The new Webster Unit Ventilator meets all three requirements in a single unit designed especially for school installation. It *ventilates* as it heats or cools—assures gentle circulation of filtered air at the right temperature throughout the room. Room air and outdoor air are blended by a damper of exclusive design which assures proper ventilation and draft-free comfort. Each unit is completely self-contained. No expensive central system duct work is required. The Webster Unit Ventilator is engineered to be used with Webster "Tru-Perimeter" Walvector to provide a blanket of heat the length of every wall. Functionally styled storage units integrate Walvector and Unit Ventilator into a custom installation to complement every school interior. A fully illustrated brochure details performance and installation advantages possible only with the new Webster Unit Ventilator. Write for a copy today, or ask your Warren Webster man about the complete line of Webster System Products for Schools.

• • •

Webster "Tru-Perimeter" Walvector • Webster Cabinet Heaters and Propeller-Fan Unit Heaters • Webster Convector Radiators • Webster System Traps and Valves • Webster Unit Ventilator

WARREN WEBSTER & COMPANY, INC.
HEATING • COOLING / CAMDEN 5, NEW JERSEY

This mark tells you a product is made of modern, dependable Steel.

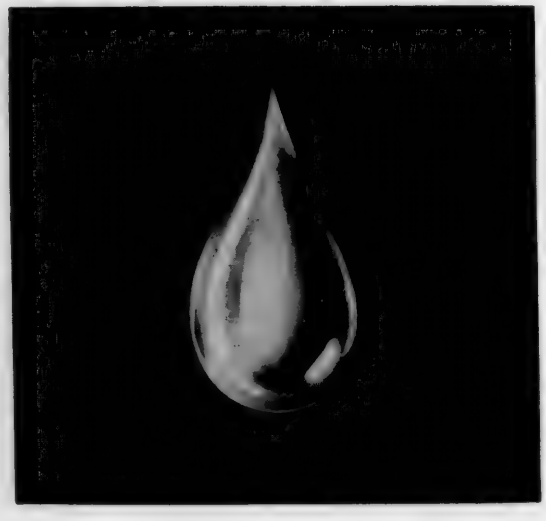
Death of a snowflake

Pity the luckless snowflake that lands on a sidewalk, when lying-in-wait, 3½ inches below the paved surface, is the dreaded enemy of all snowflakes—a modern steel pipe snow-melting system.

These systems spell instant death for all snowflakes. And, they're ideal for installation around office buildings, hotels, churches, theaters, bus terminals, airports and highway toll gates. When you're planning snow-melting systems, be sure to include USS National Steel Pipe in your plans.

For more than 60 years, National Pipe has been the consistent choice of architects, engineers and contractors for every type of tubular application. It's the largest selling pipe in the world. For more information, write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. *USS and National are registered trademarks.*

The world's largest and most experienced manufacturer of tubular products



National Tube Division of United States Steel

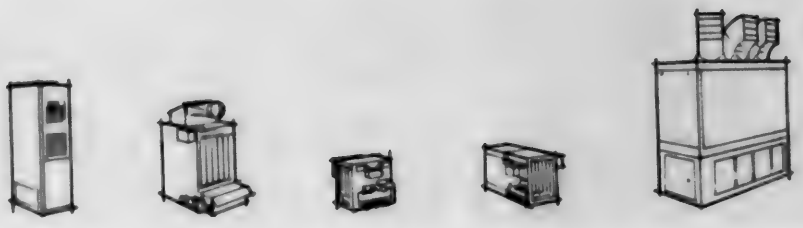
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

are you heating the **wrong half** of your building?*

- direct-fired vs "wet" industrial heating
- heating and air conditioning
- make-up air and ventilation
- process work

*

you won't if you use

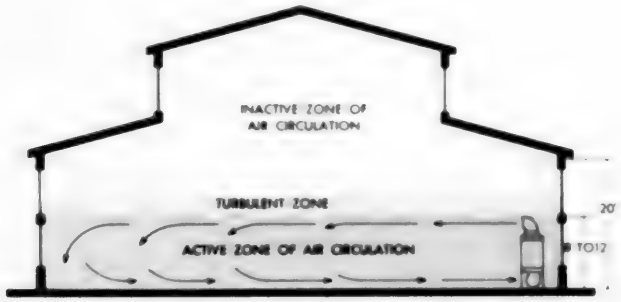


LENNOX

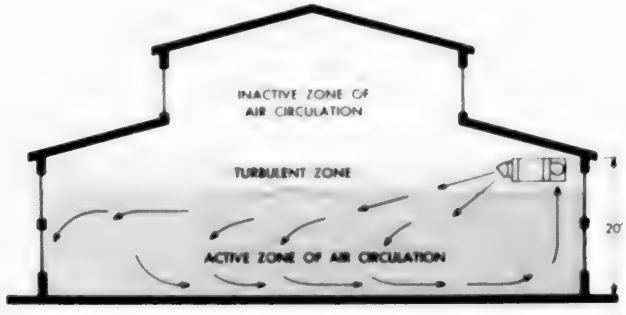
Commercial Equipment

get the most heating . .

Most industrial buildings are hard to heat and have high heat losses. Usually the heating system simply dumps enough heat into the building to keep the work level near the proper temperature. This wastes heat, causes drafts, creates "hot spots" and causes high ceiling temperatures. Lennox industrial heaters overcome such faults. The large capacity blowers and low internal resistance of the heaters make it possible to discharge large volumes of high velocity air above the heads of the workers. This eliminates hot spots and levels temperatures in all parts of the building. By locating the Lennox heaters on the floor you get more air changes per hour because only the air in the active zone (work level) is circulated. Because Lennox units heat only the work level, a minimum floor to ceiling temperature gradient can be maintained. Keeping the ceiling temperature at a minimum and circulating only the air in the work area with Lennox heaters considerably reduces the cost of heating industrial buildings.



Floor mounted units provide air circulation at the working level. Air volume to be circulated is reduced, resulting in maximum number of air turnovers per hour in the active zone of air circulation.

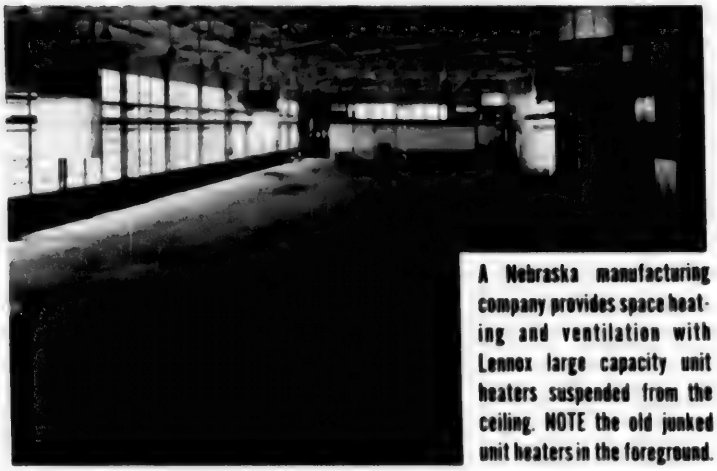


Suspended heaters located at the roof line must handle larger volumes of air in order to provide the same number of air turnovers compared to floor mounted equipment.

. . . with the least expense with LENNOX space heaters

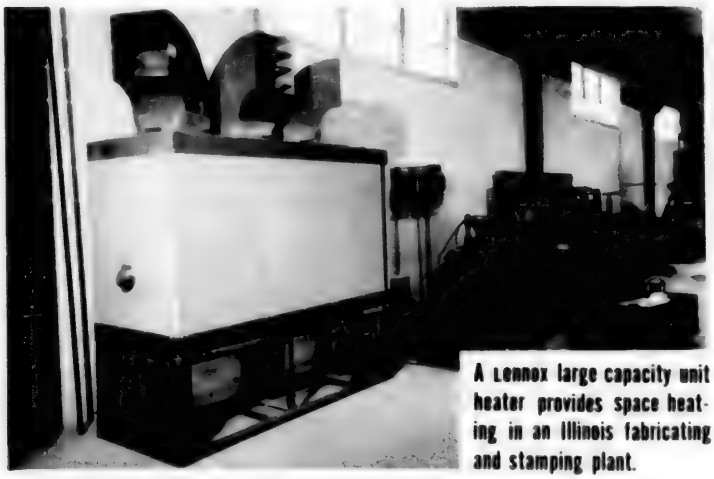
- direct-fired vs "wet" industrial heating
- heating and air conditioning
- make-up air and ventilation
- process work

*



A Nebraska manufacturing company provides space heating and ventilation with Lennox large capacity unit heaters suspended from the ceiling. NOTE the old junked unit heaters in the foreground.

Lennox was chosen as replacement equipment for three reasons. The old unit heaters supplied enough spot heating for the previous use of the building, but would not provide sufficient heat when the building usage was changed. Now Lennox heaters provide uniform wall to wall coverage with no "hot spots". These units are equipped with both make-up air dampers and dual fuel burners. The air exhausted from the building is replaced by the heater rather than by infiltration of cold air. Considerable fuel cost reduction is realized with the dual fuel burners on the Lennox heaters. The plant is now on a money saving, interruptible gas supply rate not possible with the old heaters.



A Lennox large capacity unit heater provides space heating in an Illinois fabricating and stamping plant.

Lennox units were chosen for this job primarily for their large air handling capacity and their good service record in previous installations. The heaters are located along the outside wall and provide uniform temperature control over the entire building width. These units are oil fired with stack controls.

LENNOX

Commercial Equipment

LENNOX direct-fired unit heaters

A NEW BURNER CONCEPT . . . MANY FUEL CHOICES PLUS INSTANT CHANGEOVER . . THREE CONTROL CHOICES. ON-OFF, HI-LO-OFF, MODULATING

Automatic Changeover
A flip of a switch changes to standby fuel. No burner changes are required. One burner fires all fuels.

Integral Burner Design
"OG" burners are an integral part of the unit. For gas, oil or dual fuels.

Heat Exchanger
Meets U. L. requirements when subjected to 180°F. rise over stainless primary and aluminized secondary surfaces. No internal baffles.

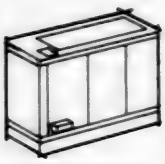
Single Motor Operation
One motor operates fuel unit when required, also induced draft and combustion air blowers. Combustion air is pre-heated.

Quiet Running Blowers
Move large volumes of air at office-quiet sound levels. Motor mounted on adjustable rails. Blower capacity and low internal resistance mean good adaptability to air conditioning.

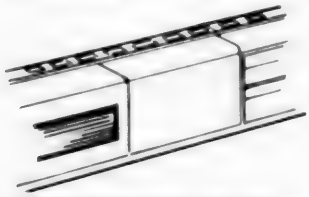
Floor, Suspended Mounting
Designed to mount in any position: up-flo, down-flo or horizontal-flo, with or without service platforms.

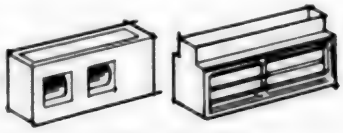
Master Program Controls
Enclosed to prevent tampering or damage. Fireye electronic safety controls standard on all units. Stack control optional on oil units.

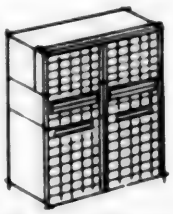
FULL LINE . A UNIT FOR EVERY JOB


CENTRAL FURNACES

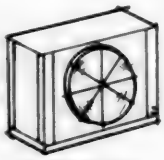
UNIT HEATERS

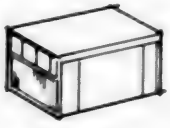

COMFORT CURTAIN CLASSROOM EQUIPMENT

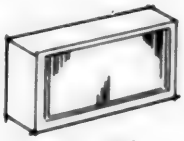

BLOWERS AND DAMPERS

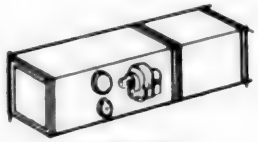

LANDMARK BLOWER-HEATER-COIL UNITS

DUCT FURNACES


CONDENSING UNITS


HEAT PUMPS


COILS


SUSPENDED UNITS

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AFTERCOOLERS
CONDENSING
EVAPORATING
BOILING
BLAST COILS
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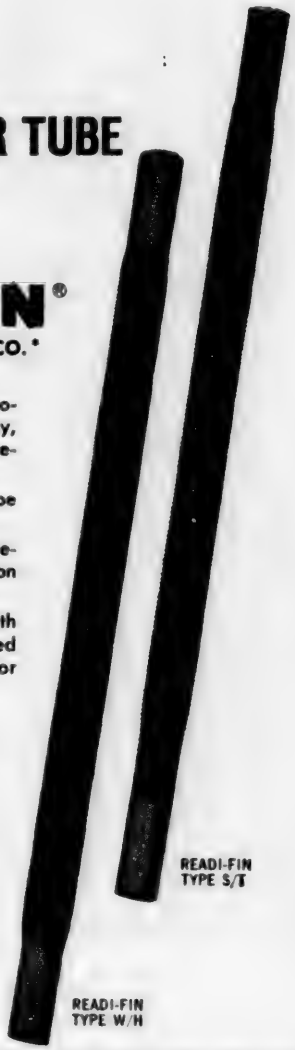

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For COPPER REFRIGERATION TUBE *Specify* READING "LEKTROSEAL"®

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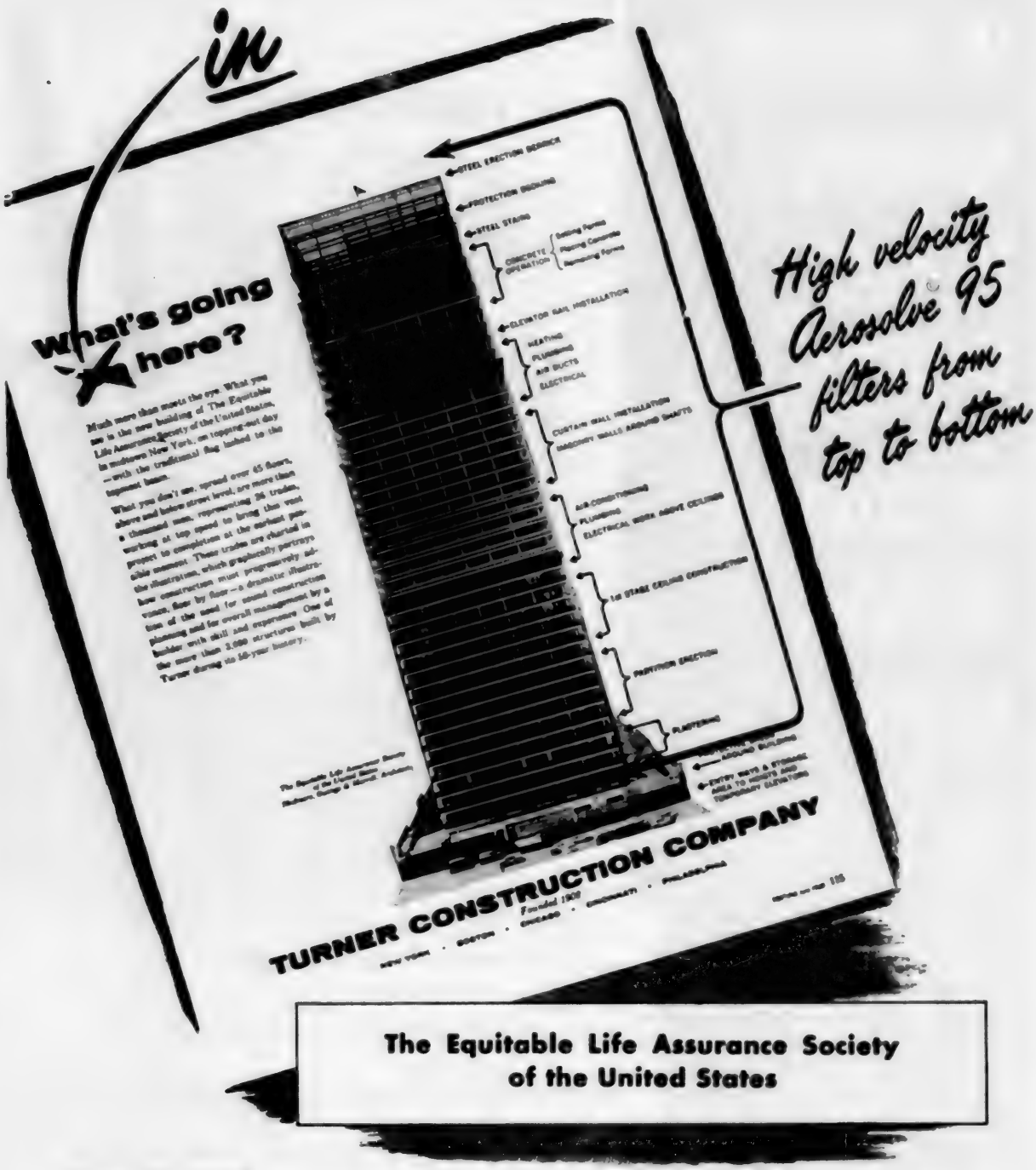

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We thank Turner Construction Company for permission to use their advertisement as a report on this significant project and for their skill in scheduling the smooth delivery of the Cambridge AEROSOLVE Filters which will keep 1,300,000 c.f.m. of air really clean throughout the building.

Cambridge Filter Corporation

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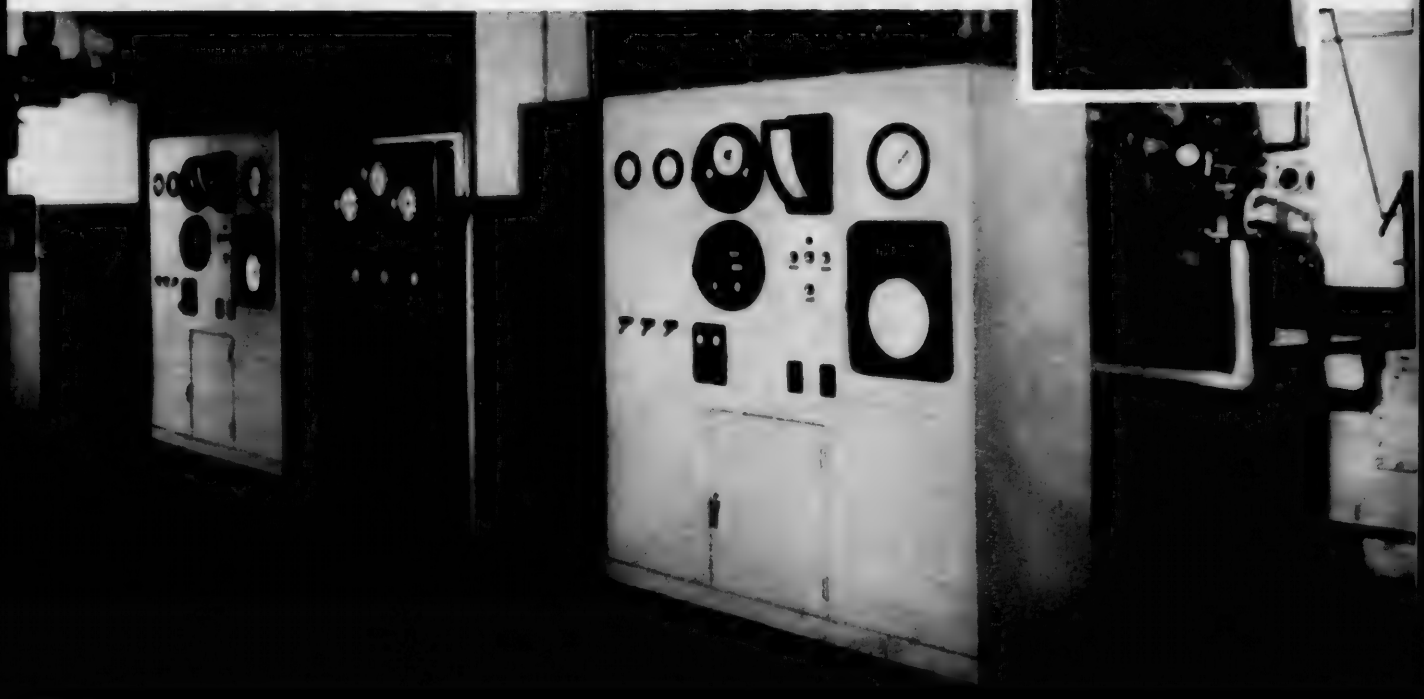
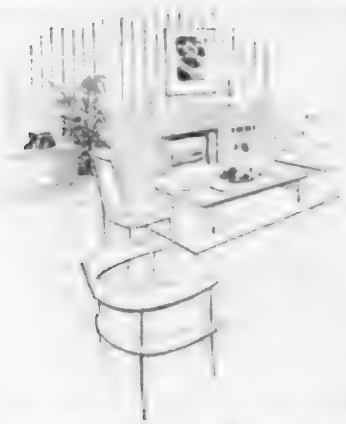
New B&W Boilers Cut Heating Costs 22% for Country's 3rd Largest Building





American Furniture Mart Corporation replaces 3 previous boilers with 2 B&W package units . . . Heats 29 Million cubic feet at fuel cost saving of 22%

The American Furniture Mart dominating Chicago's skyline with a 17 story building topped by a 33 story tower . . . has 29 million cubic feet of space to be heated. It is the largest commercial building in the world devoted to a single industry, home furnishings. Throughout the year, it is the national purchasing center for thousands of retail stores, large and small, and at peak markets, upwards of 45,000 buyers and sellers shop its display spaces. The recent installation of two B&W boilers . . . in place of three previous units . . . provides all the steam necessary for this large heating job at a fuel cost saving of 22%. Additional economies can be realized because fuels can be switched in a matter of minutes to use the fuel most economical at any given time. Moreover, these new boilers are fast steaming . . . put out plenty of heat in a hurry even after being turned off all night.

In addition to cutting fuel costs, a savings that will pay for the units in five years, these B&W package boilers cut space requirements in half and require fewer men to keep them in operation. It is interesting to note, too, that these boilers were installed during the height of the heating season . . . with minimum loss of heat to the building's occupants during the changeover period. Furthermore, management knows that any time in the life of the boiler—10, 20 or 30 years hence—B&W's nation-wide service organization will be promptly and economically available if needed.

Providing the efficiency, economy, and service necessary to heat the country's third largest building economically is further evidence-in-action of dependable steam generation by B&W. Whatever your steam requirement . . . whatever your most economical fuel . . . B&W has the boiler best suited to your heating application. For information, contact your local B&W representative. He has all the facts on your area. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

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BOILER DIVISION

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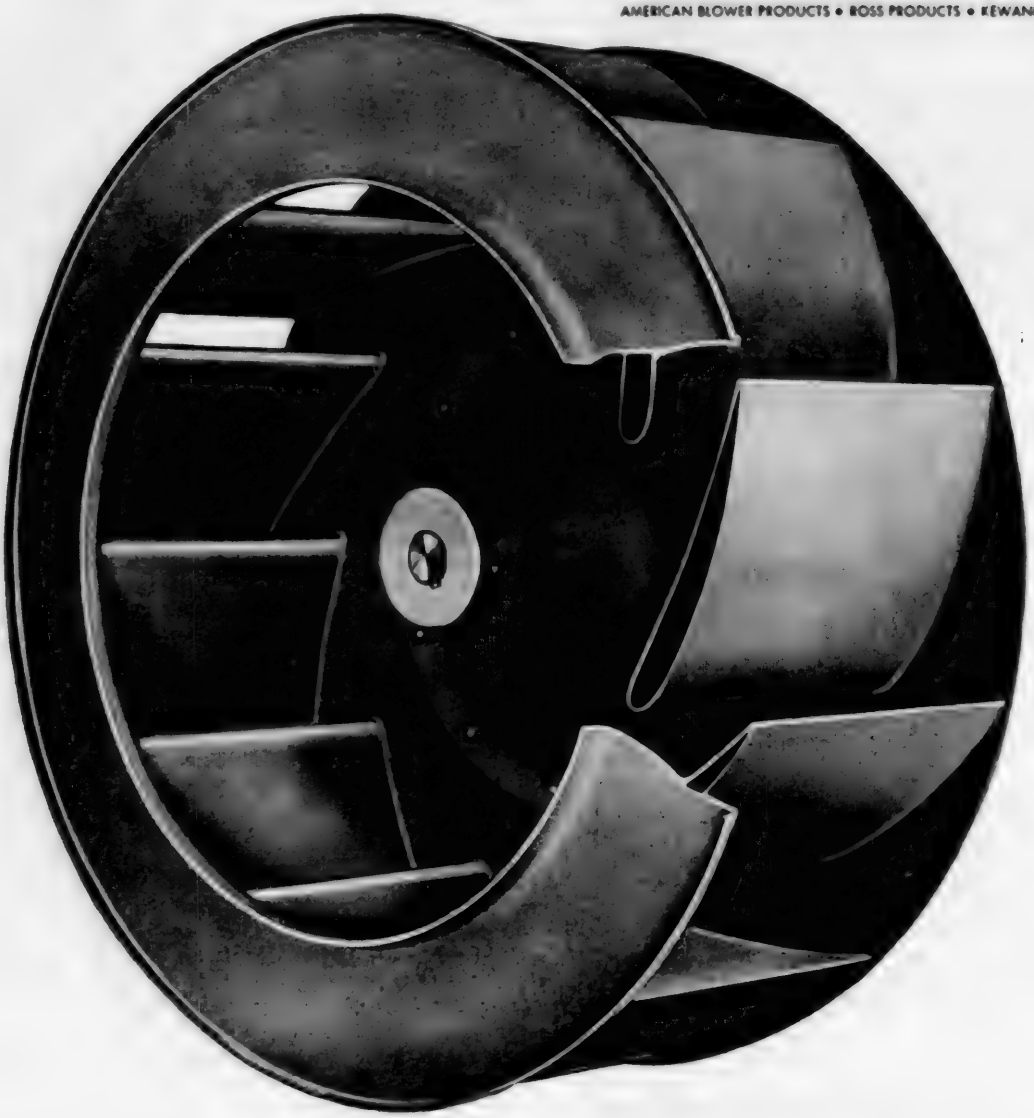

Something new for the air conditioning boys... and coils!

Now, Air Handlers from Halstead & Mitchell in 880 to 47,500 CFM Range

AH Series Air Handling Units

Before you buy any Air Handler, check and compare these new H&M units, feature for feature and price for price.

See how easily H&M Air Handlers accommodate matching cooling and heating coils, with space for up to 12 rows of coil depth overall! If you like, H&M coils (from 2 to 68 square feet of face area) can be factory-installed, leaving protruding connections on either side for easy hook-up. Halstead & Mitchell makes the coils you need to match: direct expansion, chilled water, hot water, standard or non-freeze steam. Filter sections are also available.

Performance? H&M Air Handlers deliver air against static loads up to 2-inches water gauge, and do it quietly.

Construction? They're the sturdiest units in the field. Forward curved centrifugal blowers are enclosed in a heavy gauge cabinet featuring formed steel corner posts and flush mounted panels.

Price? Just ask your H&M distributor. You'll be pleased. He has all the engineering information, too. Or, you can write for Bulletin AHU-100, Halstead & Mitchell, Bessemer Building, Pittsburgh, Pa.

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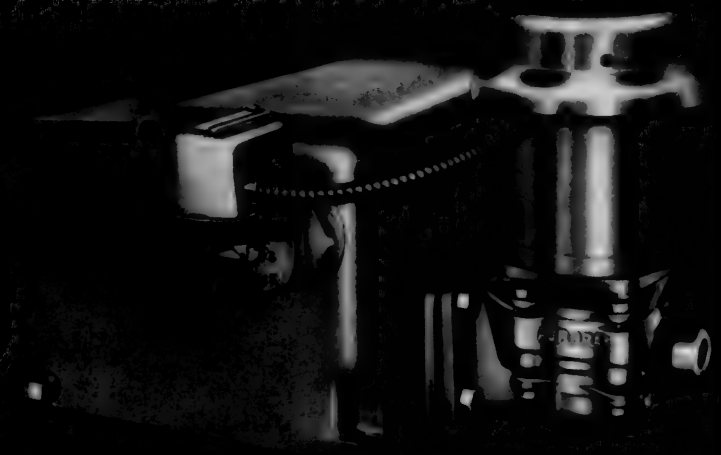
CONDENSATION RETURN UNITS



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- Self venting ... will not vapor lock.
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- Simplex or Duplex units.

Aurora Pump specialists are always available for consultation on your requirements

FOR GREATER CAPACITIES ... OR SPECIAL CONDITIONS

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Capacities to 100,000 EDR 150 GPM

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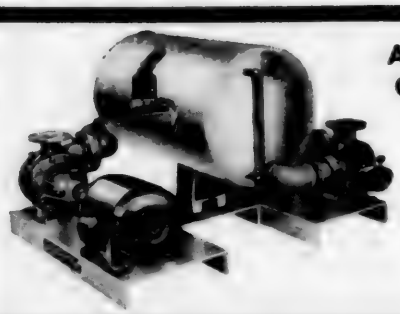
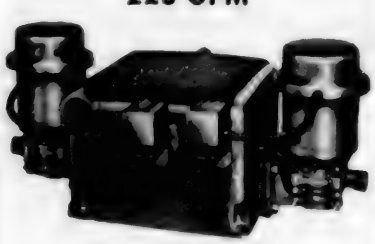


APCO HORIZONTAL UNITS Capacities to 100,000 EDR 150 GPM

With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS Capacities to 150,000 EDR 225 GPM



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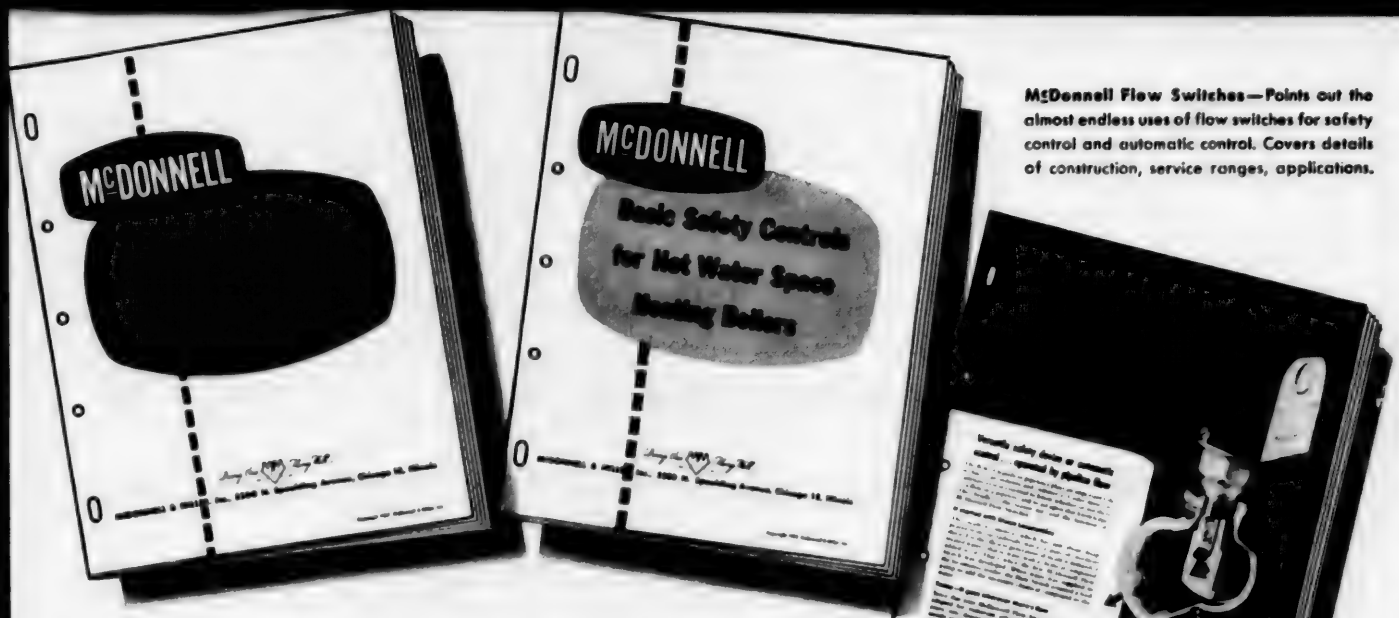

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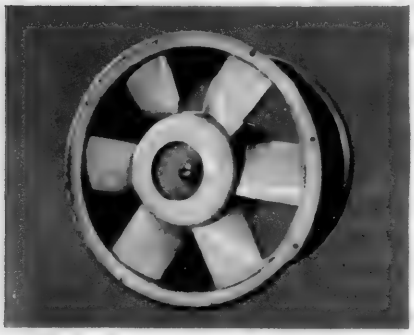
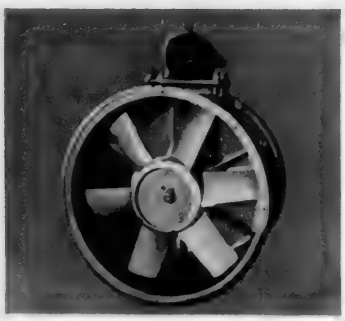
New Features at Lower Cost Offered by New Designs of Wing Roof Ventilators and Fan Equipment





Three new distinctively designed roof ventilators offer Wing's famous sturdy construction plus many new features at lower prices. Some of the unique features of these new models are nylon damper bearings, rubber and magnetic snubbing of dampers for weathertight closing and flutter elimination, and hinged windguards.

Now you, too, can benefit from the experience Wing has gained over many years as a builder of fan equipment to the exacting requirements of maritime and military specifications. The new Wing vaneaxial and tubeaxial direct and belt-driven models provide top quality and distinctive design features at lower prices than before.

Write today for information on this new equipment and how it can solve your summer ventilating problems.

WC181

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DIVISION OF AERO SUPPLY MFG. CO. INC.
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Bethlehem steel pipe in some of Manhattan's most significant new buildings

Bethlehem steel pipe was used in the heating and air conditioning system in the Corning Glass Bldg.

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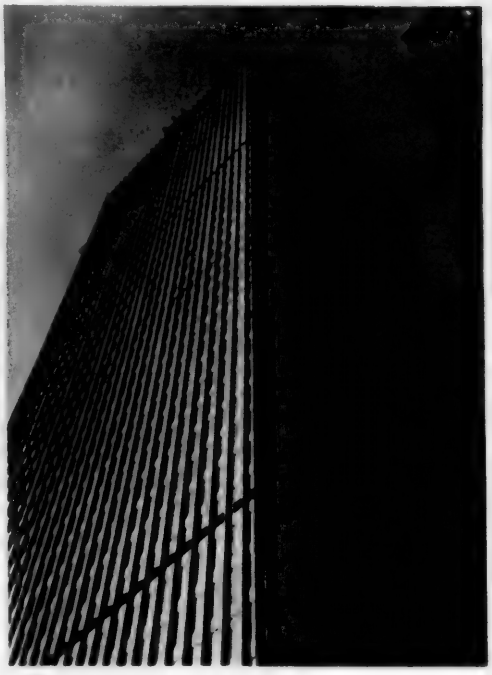
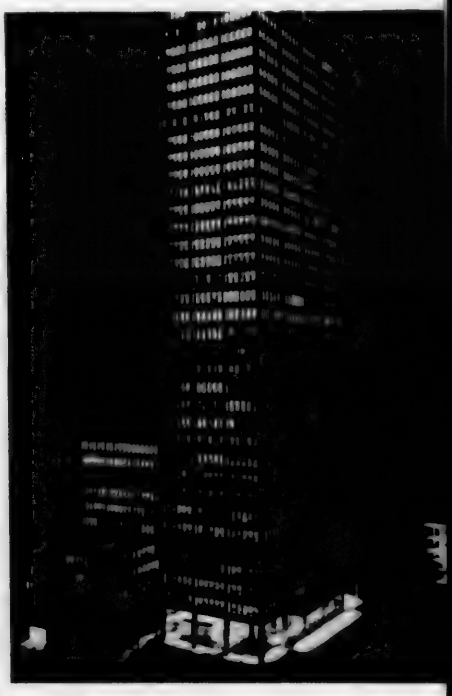
Bethlehem steel pipe was used in the heating and air conditioning system of No. 2 Broadway.

Arch., Emery Roth & Sons; *Gen. Contr.*, Uris Brothers, Inc.; *Mech. Engr.*, Rutherford L. Stinard; *Heat & Air Cond. Contr.*, Raisler Corp.; *Pipe Jobber*, Charles F. Guyon, Inc.



Bethlehem steel pipe was used in the drainage, vent, and fire lines of the Union Carbide Bldg.

Arch., Skidmore, Owings & Merrill; *Gen. Contr.*, Geo. A. Fuller Co.; *Struct. Engr.*, Weiskopf & Pickworth; *Mech. Engr.*, Syska & Hennessy; *Plumb. Contr.*, Jarcho Brothers, Inc.; *Pipe Jobber*, Charles F. Guyon, Inc.



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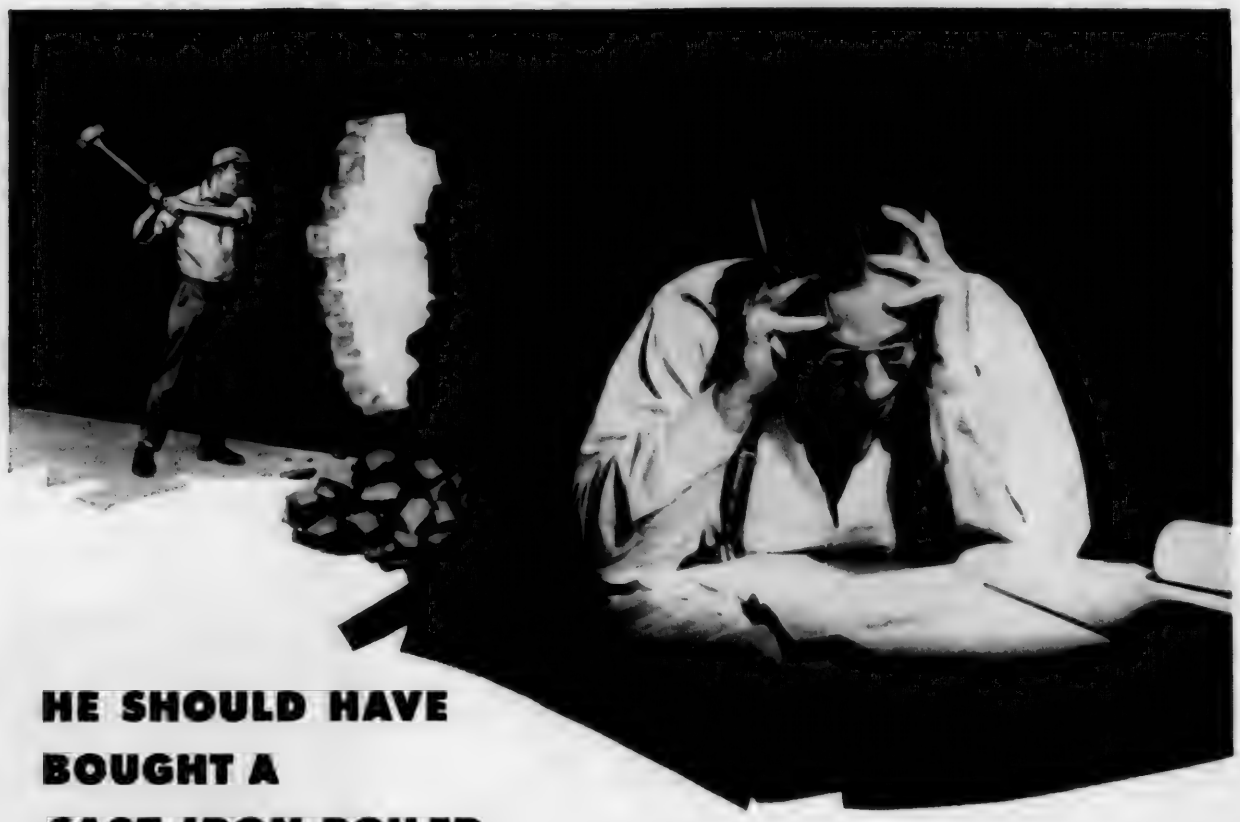

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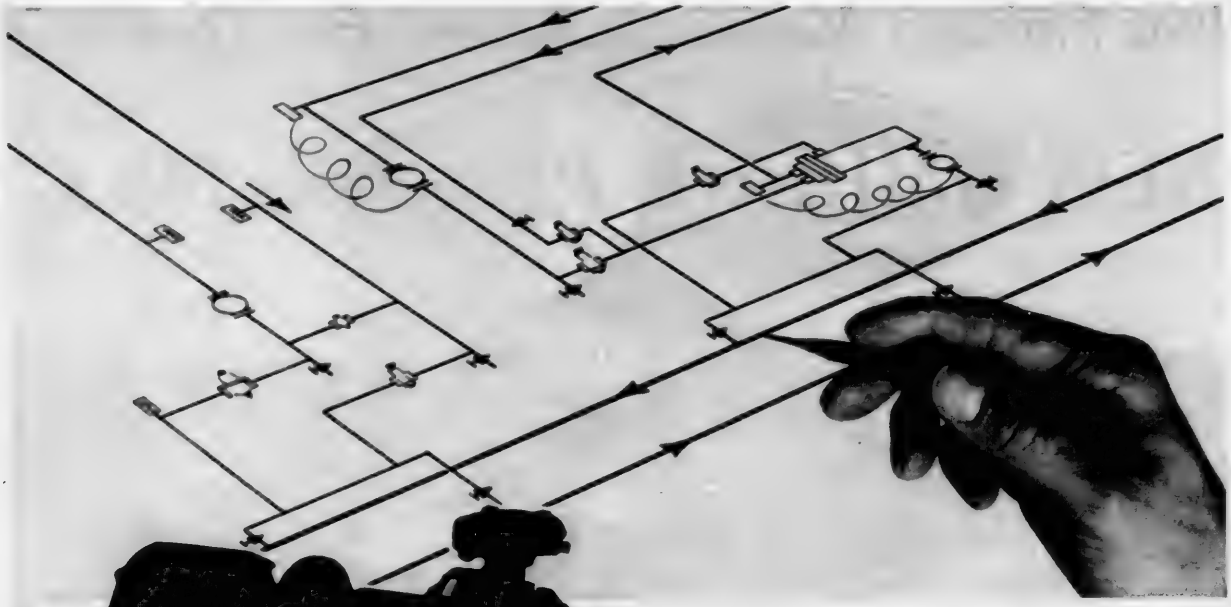

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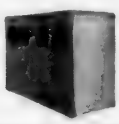

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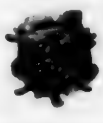

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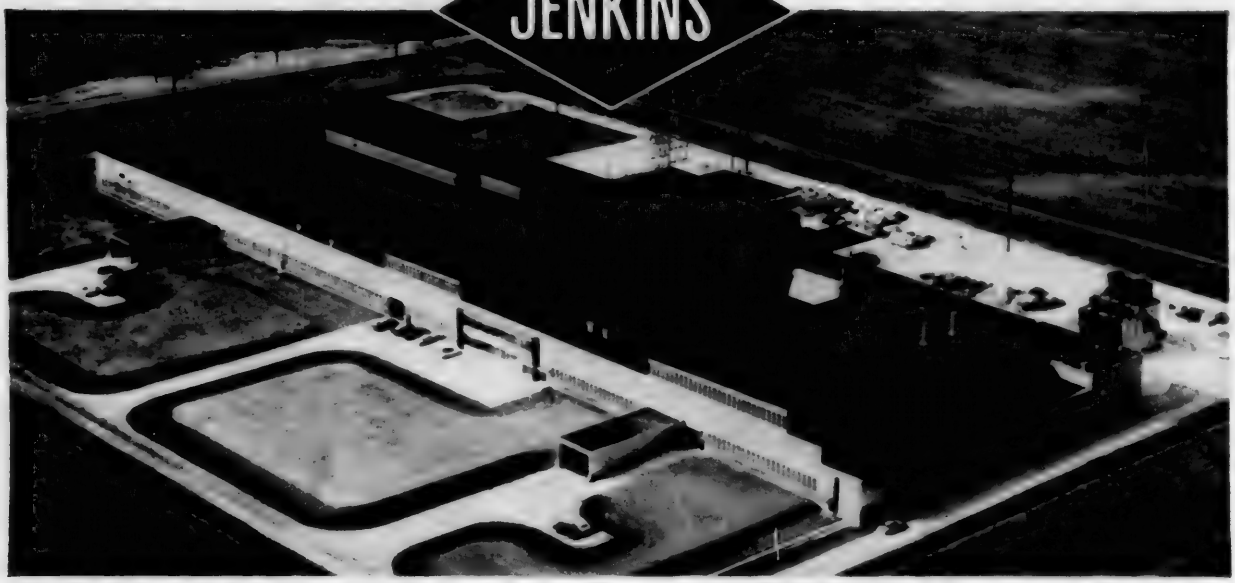

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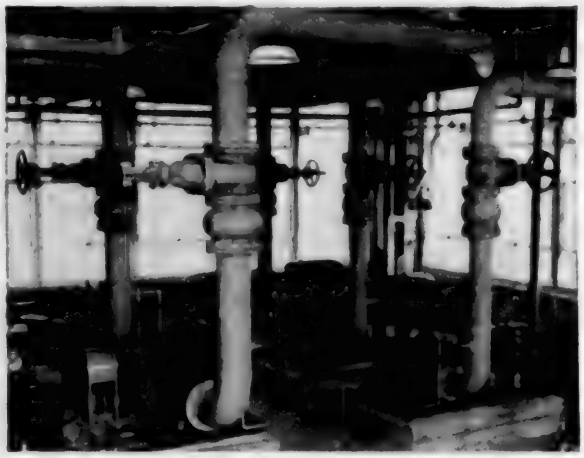

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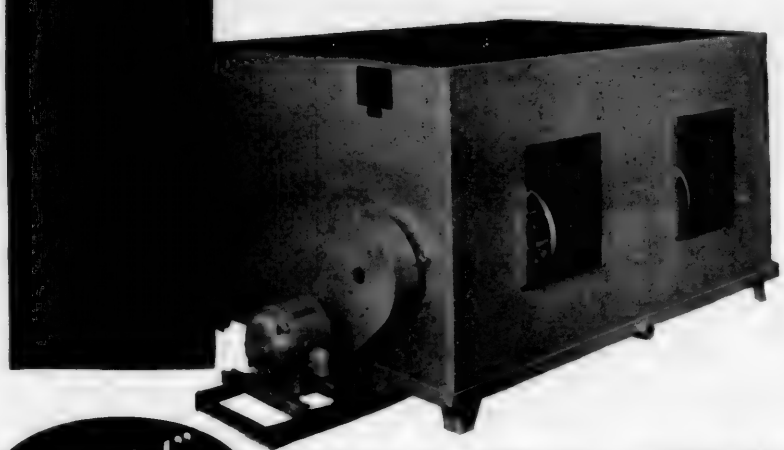

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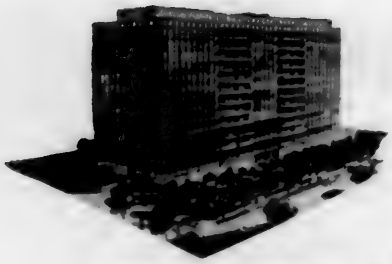

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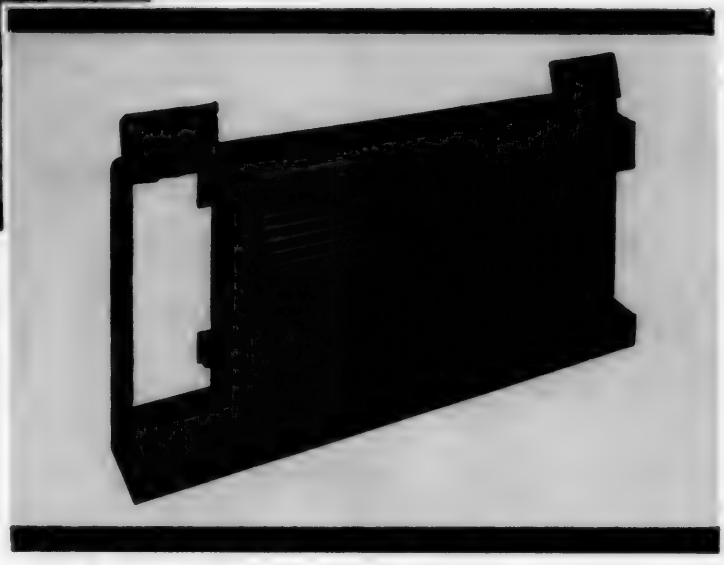

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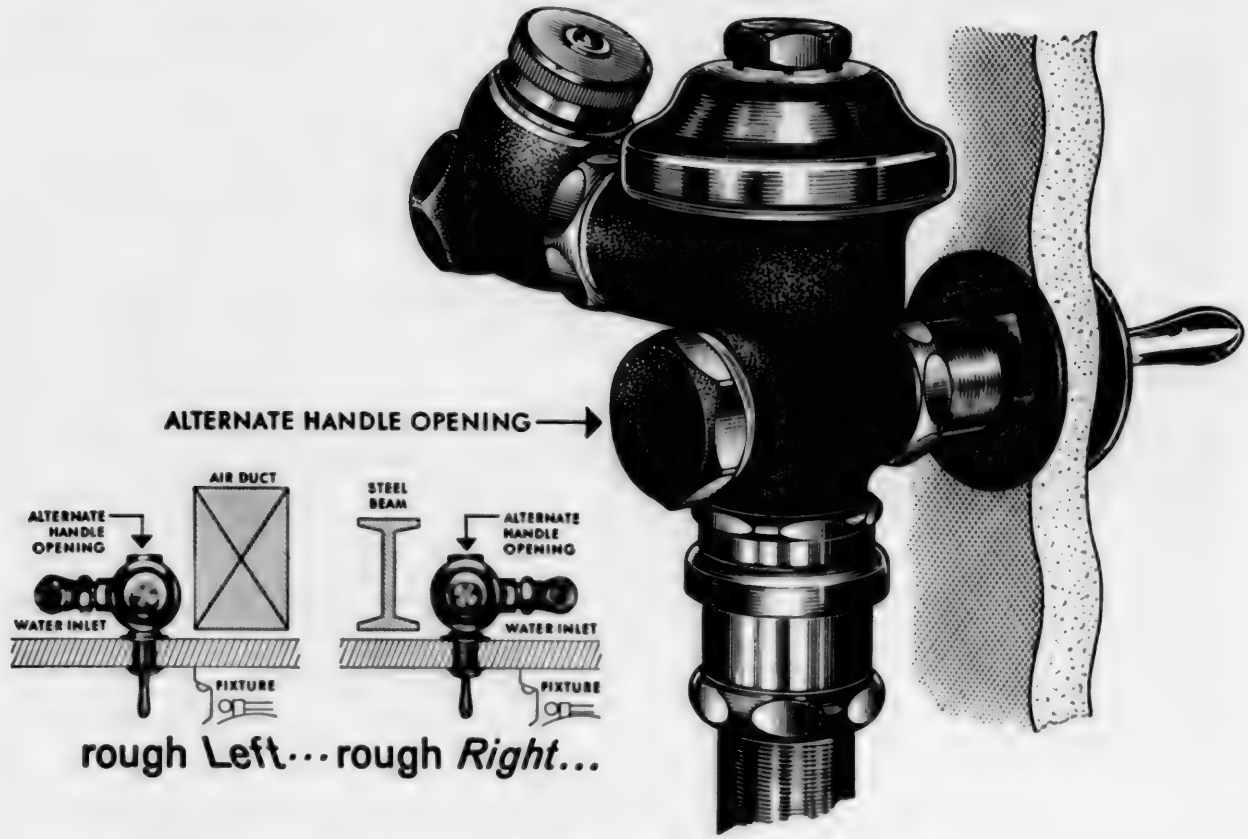

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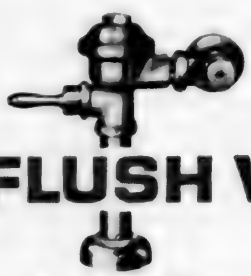

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Selecting the right orifice for a given range of flows is ordinarily a tedious business. However, with the aid of the chart herein presented, the task is greatly simplified. Following is a description of the chart, a step-by-step procedure for sizing the orifice with the aid of the chart, and an example of its use in sizing an orifice for a wind tunnel.

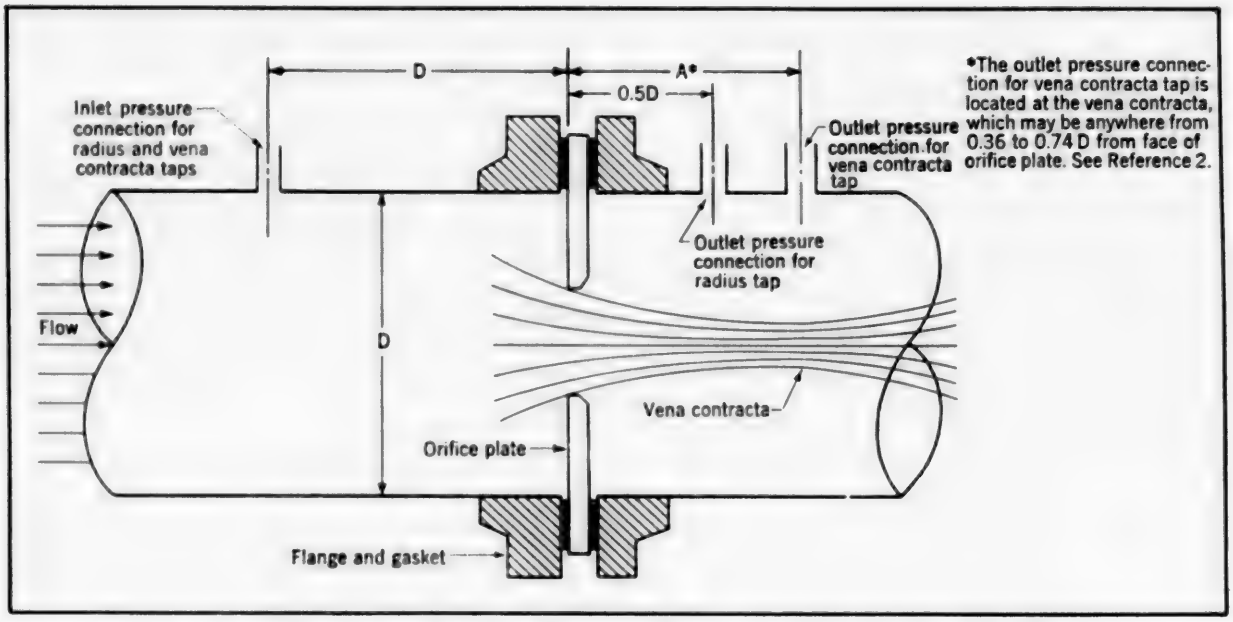
D
A*
0.5D
Inlet pressure connection for radius and vena contracta taps
Outlet pressure connection for vena contracta tap
*The outlet pressure connection for vena contracta tap is located at the vena contracta, which may be anywhere from 0.36 to 0.74 D from face of orifice plate. See Reference 2.
Outlet pressure connection for radius tap
Flow
D
Vena contracta
Orifice plate
Flange and gasket

Fig. 1. Location of taps used with concentric, thin-plate, and square-edged orifices.

Chart Speeds Orifice Sizing

RICHARD S. BRIEF

Industrial Hygiene Engineer, Medical Research Div., Esso Research and Engineering Co., Linden, New Jersey

THOUGH THERE ARE MANY quantity rate meters available to measure the flow of fluids in pipes and ducts, the orifice deserves special consideration because of its low cost, well established coefficient of discharge, ease of installation and replacement, and general acceptance by industry.

The Chart Explained

Curve 1 of the orifice sizing chart, Fig. 2, relates the dimensionless pressure drop across an orifice to β, the ratio of orifice to pipe diameter, according to the equation that is given along the side of the curve. In this equation, the coefficient of discharge, C, is taken at 0.61, a value which is substantially correct for radius and vena contracta taps at Reynolds numbers greater than 10,000. See Fig. 1.

Curve 2 of Fig. 2 relates non-recoverable pressure drop, or loss across the orifice plate, to the same β as does Curve 1. (See Reference 1.) The equation of the curve is also given on the chart.

How to Use the Chart

The steps required to size an orifice follow:

1. Determine the minimum and maximum flow rates that will be or are being used in the piping system under consideration.

2. Calculate, estimate, or measure the pressure drop for the piping system, excluding the orifice plate, at maximum flow rate.

3. From the fan (or pump) selected, or by arbitrarily

Richard S. Brief received his BChE from Cooper Union in 1952. After two years with the U. S. Atomic Energy Commission in process development, he spent another year at National Lead Company of Ohio's Uranium Refinery in pilot plant activities. In 1955, he received a commission in the U. S. Public Health Service and served two years working on engineering evaluation of air pollution problems. After the Service, in 1957 he joined the Esso Research and Engineering Company as an industrial hygiene engineer and is now employed there. At Esso, Mr. Brief covers the fields of ventilation, air pollution, illumination and mathematical techniques within the Medical Research Division. A registered professional engineer in New York, he is a member of the American Society of Heating, Refrigerating and Air Conditioning Engineers, American Industrial Hygiene Association, and the Illuminating Engineering Society. He has published widely in the fields of air pollution and ventilation.

assuming a practical power limit, determine the non-recoverable pressure drop available for the orifice plate at maximum flow. This value is the total drop available, minus the system drop without orifice, at maximum flow.

The pressure drop available for the orifice at maximum flow, obtained in Step 3, above, divided by the velocity head in the pipe or duct at maximum flow, yields the number of velocity heads available for non-recoverable pressure loss , Δh_L:

$$\Delta h_L = L/h \text{ (dimensionless)}$$

where L = permanent pressure loss caused by orifice, in inches of water column, and
h = velocity head in pipe, inches of water column.

From Fig. 2, Curve 2, with Δh_L known, the β ratio is determined and the orifice sized.

The number of pipe velocity heads corresponding to an orifice reading, Δh_R, is simply the manometer reading divided by the velocity head in the pipe, that is,

$$\Delta h_R = R/h \text{ (dimensionless)}$$

where R = orifice reading in a vertical manometer, inches of water column, and
h = velocity head in the pipe, inches of water column.

The minimum acceptable orifice reading may be arbitrarily chosen, and from knowledge of the velocity head at minimum flow, obtained from Step 1, Δh_R for the minimum reading can be calculated. With the number of velocity heads thus calculated, Curve 1 is entered, the correct β ratio is selected, and the orifice is again sized.

If the two β ratios calculated for minimum and maximum flow are different, then more than one orifice is necessary to meter the system over its full range of flow rates. Of course, if only one flow rate needs be metered, then Step 3 only would be used to get Δh_L for that flow. Curve 2 would be used to obtain the correct ratio and the orifice selection would have been made.

Reynolds Number in the pipe should be checked at minimum flow conditions to be sure it exceeds about 10,000. If N_{Re} is less, then the coefficient 0.61 may be in error. In that case, one might use the ASME tables of coefficients. (See References 2 and 3.)

An Example

Consider a wind tunnel which will be used for calibration purposes. A maximum flow of 1767 cfm and a minimum flow of 219 cfm are required. An 8-inch duct will be used. The tunnel will handle standard air (70 deg F and 760 mm Hg). Air bleed dampers and variable fan speed will be provided to give extreme flexibility in operation.

At minimum flow, 219 cfm, Reynolds Number is found to be 43,200, that is, above 10,000, so that the assumption of $C = 0.61$ is valid for the entire range.

Calculation of pressure drop, excluding orifices, at maximum flow, 1767 cfm, yields a figure of 3.0 inches of water. At this flow, and within the power limitations set, the fan selected can develop a pressure of 9.0 inches. Thus, the non-recoverable pressure loss available for the orifice at maximum flow is 9.0 minus 3.0, or 6.0 inches.

Orifice for Maximum Flow

The velocity head in an 8-inch duct, at 1767 cfm, is 1.60 inches. Then the pressure loss caused by the orifice, is $\Delta h_L = L/h = 6.0\ 1.60 = 3.75$ velocity heads. Entering Curve 2 at $\Delta h_L = 3.75$, β is found to be 0.715. The correct orifice size is β times the duct diameter, or 0.715×8 inches $= 5.72$ inches.

Entering Curve 1 at $\beta = 0.715$, the orifice reading, Δh_R is found to be 7.6. Since $\Delta h_R = R/h$, and h, the velocity head in the pipe is known to be 1.60 inches, we can solve for R, the orifice reading: $R = h(\Delta h_R) =$ 1.60 inches $(7.6) = 12.2$ inches reading.

(A recommended value for the minimum orifice reading in a vertical manometer is 5 inches of water column. Below that figure, accuracy is sacrificed. Since an inclined manometer can easily give a magnification of 1:5, the minimum acceptable pressure for the orifice is taken as one inch of water column.)

In the present case, a minimum of one inch of water was chosen, since a combination of vertical and 1:5 inclined manometers will be used. What, then, is the lower limit of flow that can be read with the orifice selected?

It has already been found that Δh_R, the number of pipe velocity heads, is 7.6, and this value is constant for the same orifice for all rates of flow, it being a function of β only. Since Δh_R, the manometer reading, here taken at one inch, divided by h, the velocity head in the pipe, $= R$, then $h = R/\Delta h_R = 1$ inch $/ 7.6 = 0.132$ inches of water column. This velocity head corresponds to 1454 fpm, or 508 cfm in the 8-inch duct. Therefore, the orifice selected, within the limitations established, can be used to meter 508 to 1767 cfm.

In most situations, the one orifice will suffice. In this case, however, it is desired to meter down to 219 cfm, so that a smaller orifice must be selected for the lower range.

ORIFICE SIZING CHART

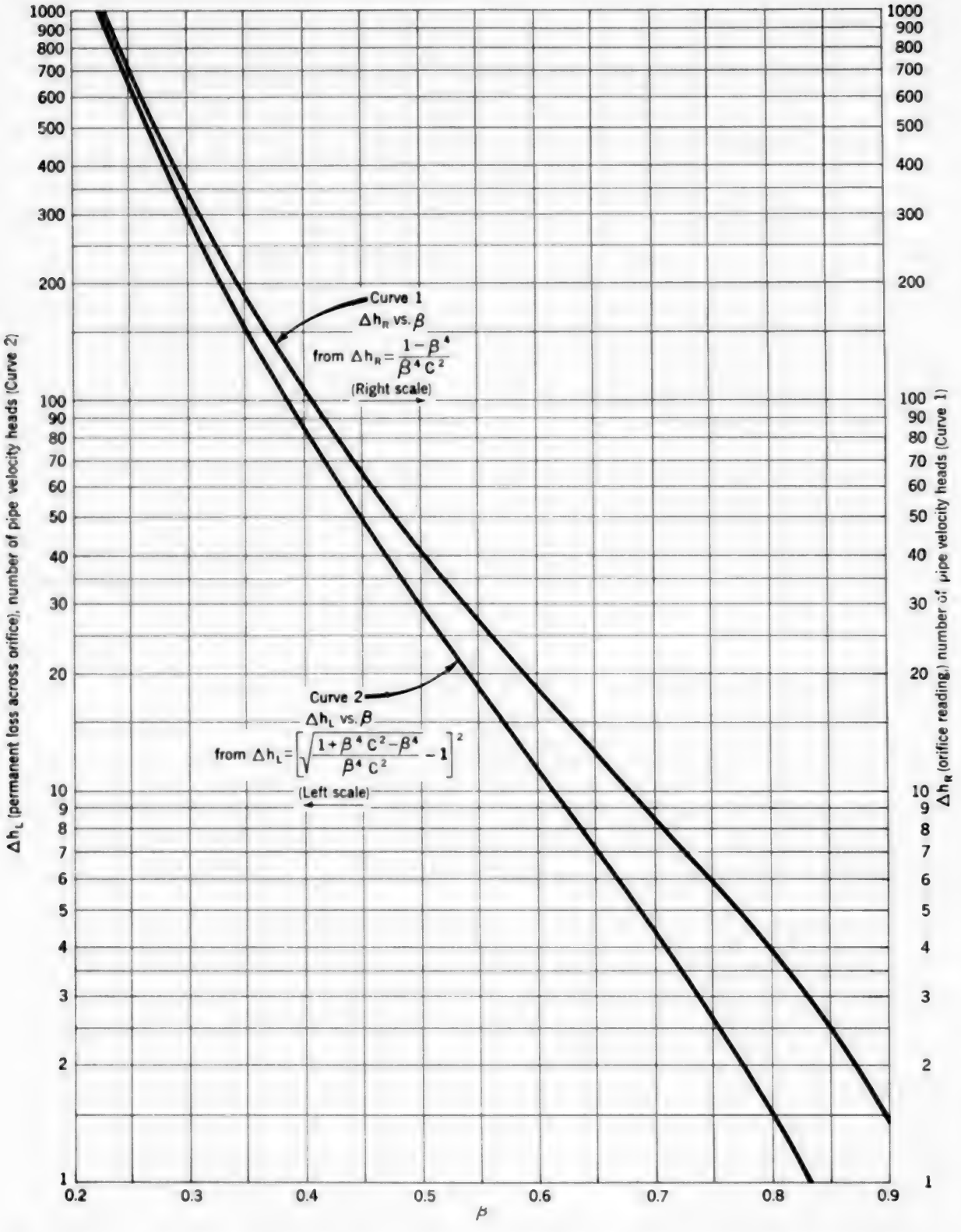

Fig. 2. Curve 1, the upper of the two curves, is the manometer reading, in number of pipe velocity heads, across an orifice, as a function of the ratio of orifice to pipe diameter. Curve 2 relates the permanent loss across the orifice, in the same units, to the same dimensionless ratio. Do not use when Reynolds Number is below 10,000.

Sizing the Smaller Orifice

At the minimum flow of 219 cfm, the velocity in the 8-inch duct is 628 fpm, which corresponds to a velocity head of 0.025 inches of water column. Again, a minimum acceptable manometer reading is one inch. This reading, in terms of pipe velocity heads, is $\Delta h_R = R/h =$ 1 inch/0.025 inch = 40. Entering Curve 1 at $\Delta h_R = 40$, β is found to be 0.50. The correct orifice size, then, is $\beta \times D = 0.50$ (8 inches) = 4.0 inches.

To determine if the flow ranges of the two orifices overlap, an estimate of the upper metering limit of the smaller orifice is made. A value of about 120% of the lower limit of the larger orifice is used. If the head developed by the fan is greater than that required by the smaller orifice at its upper metering limit, then the two orifices will indeed cover the complete range of flows and the sizing task is completed.

The lower limit of the large orifice is 508 cfm, and 120% of it is 625 cfm, which, in an 8-inch duct, produces a velocity head of 0.20 inches. From Curve 2, at $\beta = 0.50$, $\Delta h_L = 29.5$. The orifice loss, $L = h(\Delta h_L) = 0.20$ inches (29.5) = 5.90 inches of water.

The system loss, the loss without the orifice, at 625 cfm must also be considered. Since the loss is proportional to the square of the flow rate, and we know that the loss is 3.0 inches at 1767 cfm, the loss at 625 cfm is $3.0(625^2)/(1767^2) = 0.4$ inches.

The orifice loss plus the system loss at 625 cfm is 0.4 + 5.9 = 6.3 inches of water. A check against the fan data shows that, at 625 cfm, the fan produces a head much greater than 6.3 inches. Therefore, the task of sizing the orifices is complete.

Disadvantages

Although there are many outstanding points to recommend orifices, their shortcomings ought to be mentioned. Among these are: (1) high non-recoverable head loss, (2) low capacity, (3) flanges or special construction are required for installation, and (4) unless eccentric or segmental types of orifices are used with the hole flush with the bottom of a horizontal pipe, suspended matter in the fluid may build up on the inlet side. These disadvantages of orifices, however, do not generally deter their widespread use.

ASME Specifications

References 2 and 3 detail the extensive work on orifices done by the American Society of Mechanical Engineers. For purposes of review, the ASME specifications are presented here:

(a) The orifice plate should be constructed of a non-rusting material like Monel or stainless steel.

(b) As nearly as possible, the orifice plate and the holding flange should have the same thermal expansion characteristic for orifices used in high temperature service.

(c) Thickness of the orifice plate should be as shown in Table 1.

(d) It is preferable that the orifice hole be concentric with the pipe or duct and provision made to center it accurately. References 2 and 3 contain the details for eccentric or segmental orifices.

TABLE 1—MINIMUM ORIFICE PLATE THICKNESS

Pipe Size, Inches	Thickness for Service below 600 deg F, Inches	Thickness for Service above 600 deg F, Inches
up to 3	3/32 ± 1/32	1/4
4 to 6	5/32 ± 1/32	3/8
7 to 8	1/4 ± 1/16	1/2
10 and over	3/8 ± 1/8	1/2 to 3/4

(e) Width of the cylindrical edge of the orifice hole should be between $0.01D$ and $0.02D$. If the plate is wider than $0.02D$, the outlet edge of the orifice should be bevelled, as shown in Fig. 1.

(f) Upstream orifice edge should be square and sharp. It must be free from burrs or rounding, so that when viewed without magnification, a beam of light will not be reflected visibly from its edge.

(g) Upstream face of the plate should be flat, and remain so within 0.010 inch per inch of pipe diameter.

(h) Orifice diameter should be measured in four meridian planes at 45°. No single diameter measurement should differ from the mean by more than 0.05%.

(i) The ratio, β, should be not less than 25%, or greater than 70%.

(j) In horizontal pipe, orifice may have a drain hole flush with the bottom of the pipe when metering gases, or a vent flush with the top of the pipe when measuring liquids. Area of the drain hole should be less than 1% of orifice area.

(k) Special forms of orifices may be used. One, for example, has an adjustable area opening. Such special devices should be calibrated individually through the whole range of required area openings.

Conclusion

The method described for sizing orifices to meter flow in known systems may be applied to both compressible and non-compressible fluids. Flow measurement, however, is restricted to non-pulsating flow in the turbulent region, to gases up to about 0.9 of sonic velocity and for liquids that do not contain suspended material, although colloidal solutions whose dispersion approximates homogenous liquids may be measured.

A fluid, to be successfully metered by orifices, must not change its physical state or composition in passing through the orifice, as would be the case with steam or liquids containing dissolved gases.

The reader is referred especially to References 2 and 3 for recommended construction details. Included are tables of the flow coefficient as a function of β and Reynolds Number for vena contracta, $1D$ and $0.5\ D$ (radius), and flange taps.

References

1. Lapple, C. E., Velocity Head Simplifies Flow Computation, *Chemical Engineering, 56*:96 (May 1949).
2. Flow Measurement—Measurement of Quantity of Materials, Power Test Code PTC 19.5:4-1959, Amer. Soc. Mech. Engr., New York (1959).
3. Fluid Meters—Their Theory and Application, 5th ed., Amer. Soc. Mech. Engr., New York (1959).

The higher the system pressure, the more fan heat contributes to the cooling load. One solution is to lower supply air temperature, thus cutting fan horsepower through reduced supply air requirements. When is this procedure the most economical choice?

Handling Fan Heat Loads At Minimum Cost

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POWER THAT DRIVES a fan is eventually converted into heat. In air conditioning systems, fan heat can become a very significant part of the room cooling load, especially in the case of systems operating on high static pressure.

Two factors determine the size of, and the power required to drive, a fan: the quantity of air handled and the total static pressure of the system. In any air conditioning system, the quantity of air is, in turn, dependent upon the total room sensible heat load and the temperature differential between supply and room air. That is,

$$Q = H_s/1.08\Delta T \quad (1)$$

where Q = Supply air quantity, cfm,
H_s = Total room sensible heat load, Btu per hr,
ΔT = Temperature differential, room minus supply air, deg F.

Note that the quantity of air is *not* dependent upon the velocity of air in the ducts or on the air distribution arrangement. Neither is it affected by the type of room terminal device. However, all these factors do determine the static pressure drop of the system, and, hence, fan horsepower.

Once air quantity is calculated, fan horsepower can be determined:

$$HP = 0.0001573QP/N \quad (2)$$

where HP = Required fan horsepower,
Q = Supply air quantity, cfm,
P = Total pressure, static plus velocity pressures, inches of water, and
N = Percentage mechanical efficiency of the fan.

If fan efficiency is assumed to be 75%, then Equation (2) can be rewritten, as follows,

$$HP = 0.00021QP. \quad (3)$$

Calculating Fan Heat

Fan power converted to heat is most conveniently evaluated by finding the temperature rise of the air handled by the fan. Since one horsepower is equivalent to 2545 Btu per hr, the power input of the fan in heat units can be determined by the equation:

$$h = 0.534QP. \quad (4)$$

Rearranging Equation (1),

$$h = 1.08Q\Delta t, \quad (5)$$

where h = Heat added to the air, Btu per hr, and
Δt = Temperature rise of the air, deg F.

From Equations (4) and (5),

$$0.534QP = 1.08Q\Delta t,$$
$$\Delta t = 0.494P,$$

which, upon simplification, becomes

$$\Delta t = P/2. \quad (6)$$

It can be seen that the temperature rise of the air and the fan power both depend on fan total pressure.

How Fan Heat Affects Room Cooling Load

Equation (1) shows that the net cooling effect of the supply air is proportional to the temperature differential, ΔT, while the heat added by the fan is proportional to the temperature rise, Δt. Expressing fan heat as a percentage of net cooling effect, that is,

$$\text{Percent fan heat load} = \Delta t/\Delta T \times 100,$$

and substituting from Equation (6), the following relation is seen:

$$\text{Percent fan heat load} = P/2 \times 100/\Delta T = 50P/\Delta T. \quad (7)$$

Table 1, based on Equation (7), shows that in a typical high velocity system, operating on the temperature differential of 22 deg, and a static pressure of 8 inches of water, the fan contributes 18.2 of the net room sensible heat load. This is a substantial portion of the load and deserves a proper allowance when loads are calculated.

Effect on Total Cooling Load

Analysis of Table 1 or Equation (7) indicates that the percentage of fan heat load decreases as the temperature differential increases. An increase of differential from 22 to 30 deg, in a system operating on 8 inches static pressure, for instance, reduced the fan load from 18.2 to 13.3% of the total.

Since the quantity of supply air will be reduced in direct proportion to the increase in the temperature differential, it seems profitable to operate on as high a temperature differential as practicable. Besides reducing the necessary air supply quantity and the fan heat load, supply ducts will be smaller, supply fan size will be reduced, there will be smaller return air ducts, and return air fans need not be as large.

In some systems, this reduction in return air quantity may be sufficient to justify elimination of the return air system altogether, allowing the supply unit to operate completely on outside air, eliminating mixing boxes, dampers, and associated automatic controls.

TABLE I—RATIO OF FAN HEAT TO TOTAL ROOM SENSIBLE LOAD

Temperature Differential, Room — Supply Air Temperature, Deg F	Fan Total Pressure, Inches of Water				
	2	4	6	8	10
	Percent Fan Heat				
10	10.0	20.0	30.0	40.0	50.0
14	7.1	14.3	21.5	28.6	35.7
18	5.6	11.1	16.7	22.3	27.8
22	4.5	9.1	13.6	18.2	22.7
26	3.8	7.7	11.5	15.4	19.3
30	3.3	6.7	10.0	13.3	16.7
34	3.0	5.9	8.8	11.8	14.1

Notes:

1. The difference between fan total pressure and static pressure is small if either the fan outlet velocity is not much more than 1500 fpm or if static pressure is more than 5 inches of water. Therefore, using static pressure instead of total pressure will result in a negligibly small error.
2. Since the figures are based on fan efficiency of 75%, correction is required for fans of different efficiency. Multiplying factor for correction is 75 ÷ *Actual Fan Efficiency*.
3. If the fan motor is installed in the air stream, the heat input will increase. In that case, the factor for correction is 75 ÷ *(Actual Fan Efficiency* × *Motor Efficiency)*.
4. In the case of a draw-through system, fan heat should be added to room sensible load, and in the case of a blow-through system, to room grand total cooling load.

However, increased temperature differentials create problems, too. Advantages and disadvantages must be weighed to arrive at the most economical system.

Drawbacks of High Temperature Differentials: Effect on Room Humidity

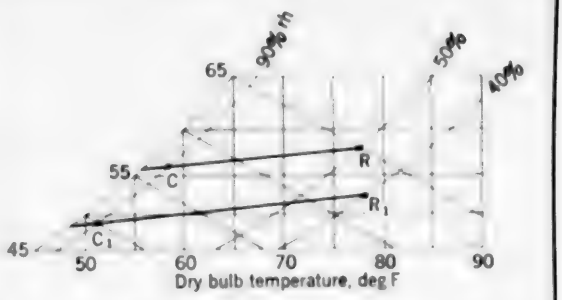
As supply air temperature is reduced, the dehumidification effect is increased, so that room humidity is lowered. This process is shown in Fig. 1.

Although a lower room humidity is desirable, it increases the dehumidification load of the outside air. This load can be substantial when the system is designed to take in large quantities of outside air. In the case of a system with high temperature differentials, room humidity should be determined *before* calculating the outside air load so that proper allowance can be made for the extra dehumidification load.

The increase in the dehumidification load can be compensated to some extent by taking advantage of lower room humidity and designing the room for a slightly higher sensible temperature, thus maintaining the desired Effective Temperature. Needless to say, the higher room temperature (at a satisfactory Effective Temperature) will occur only during peak load conditions, which could be of very short duration.

Effect on Room Air Movement

Reduction in supply air brings about a corresponding reduction in air movement in the room, which movement should not be allowed to fall below the acceptable minimum air changes per hour for the application. Further, diffusion of low-temperature air may create problems in its proper and uniform distribution. The situation can be improved by using suitably designed diffusers or room terminal devices which mix room (secondary) air with supply (primary) air before delivering it to the room. Actual mixing may be carried out either by the aspirating of a diffuser or by induction effect of jet nozzles. If a one-to-one ratio of supply to room air is achieved, room air movement is thereby doubled and the temperature differential cut in half.



R = Room condition, 78 deg, 50% rh.
C = Condition of air leaving cooling coil, 58 deg db, 56.8 deg wb.
R-C = Sensible heat line. Sensible Heat Factor = 0.85.
C_1 = Condition of air leaving cooling coil when temperature differential is 27 deg (51 deg db, 50 deg wb).
R_1-C_1 = Sensible heat line. Sensible Heat Factor = 0.85.
R_1 = Final room condition, 78 db, 40% rh.
Moisture content at R = 72 grains per lb of air.
Moisture content at R_1 = 58 grains per lb of air.
Extra dehumidification = 14 grains per lb of air.

Chart shows a system designed for a room condition of 78 deg db and a relative humidity of 50%. The system sensible heat ratio is 0.85, which gives a desired coil leaving condition of 58 deg db and 56.8 deg wb. The total temperature differential is 20 deg, which is equal to the room temperature differential plus the temperature rise caused by the fan power.

If the total temperature differential is increased to 27 deg, the coil leaving condition will be 51 deg db and 50 deg wb, which, with sensible heat line of 0.85, will result in the room relative humidity of 40%.

The extra dehumidification load in this case will be 14 grains per pound of outside air.

Fig. 1. How a greater temperature differential between supply and room air results in lower room humidity and increased dehumidification load.

Effect on Refrigeration System

If lower-temperature supply air is obtained by operating the refrigeration unit at lower suction temperature, the required horsepower per ton of refrigeration is increased. This is not very serious, considering all the advantages of designing for a higher temperature differential. It can be shown that increasing the temperature differential from 20 to 30 deg reduces the air system by 33%, while maximum increase in horsepower per ton may be only 15%.

Fan power adds to room sensible heat and the effect increases as the system static pressure is increased. Therefore, in designing any system operating on high static pressures, a suitable allowance for fan heat load must be included. In addition, the advantages and disadvantages of designing for high temperature differential should be considered if, in the interest of economical design, reduction in fan heat load is desired.

Practical Selection of

Sound Control Treatment for Duct Systems

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A simplified method of selecting and specifying sound control equipment with assurance that installation will be correct.

INCREASED use of high velocity air conditioning systems has caused a new awareness of noise as a design problem. This has led to the installation of sound suppressors in any duct system, whether high, medium or low velocity, where noise is likely to occur.

Reliable design information is almost non-existent. True, the ASHAE *Guide*, 1959, gives a procedure for quantitative analysis of a system which yields exact numbers of decibels in each octave band which must be eliminated in order for the system to be quiet. Wide acceptance of this method makes it imperative that the limits of accuracy of such a procedure be pointed out. Although no great accuracy has been claimed for it, the mere institution of such a method suggests an entirely different and higher order of accuracy than is, in fact, the case in the present state of the art of acoustics.

This does not suggest that the prediction method is useless. Rather, it can be used as a guide to the degree of silencing required. But because of the time involved, a more simple yet reliable method for determining the degree of silencing required is a practical necessity.

The familiar NC (noise criteria) curves shown in Fig. 1 and table of rooms in which they apply, Table 1, (both from the *Guide*) may be used for most applications. In general, the lower the NC curve the greater is the requirement for silencing.

The sound output of a fan increases with an increase of horsepower or static pressure.

$$PWL = 100 + 10 \log W_E + \log p$$

where PWL = sound power level of fan in dbe.
W_E = name plate electrical horsepower of motor driving fan.
p = pressure head, inches of water.
dbe = decibels for which reference power is 10^{-13} watt.

The larger the fan the more space will be conditioned by the fan. Likewise, the square feet of outlets will increase. The sound pressure which is applied to a listener's ear as a result of the sound power or energy of the fan is a function of the area of the outlets. Therefore, a correction must be made for the terminal duct area.

$$SPL = PWL - 10 \log A$$

where SPL = sound pressure level at the outlet.
PWL = sound power level of fan.
A = terminal duct area in square feet.

Numerically these factors tend to nullify each other. We have a relatively small correction for other factors in the system such as runs of straight unlined ducts and elbows.

There remains only one other factor of any magnitude—the reduction of noise from where it enters

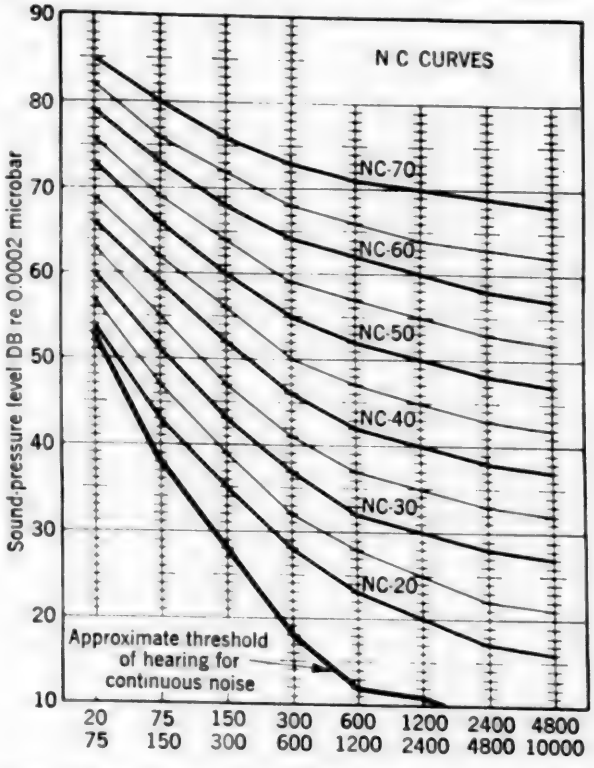

Fig. 1. Sound pressure level of various frequency bands at various criterion levels.

the room to where the listener hears it. This factor depends on the size of the room, the materials of construction, furniture, number of occupants, floor covering, position of grille or diffuser.

The effect of the noise on the listener will depend upon the ambient noise level of the room.

Therefore, for a given use of a room, the size, furnishings and ambient noise level we can usually assume that the conditions are about the same.

Based on this assumption, duct noise reduction can be based primarily on the NC curve of the room to be air conditioned. This method has been used for specifying prefabricated sound traps and has been found to be of practical value.

With this in mind, how does the engineer specify duct noise control with assurance that the contractor will install the treatment required? The engineer has various types from which to choose.

(1) Duct lining.
(2) Parallel baffles.
(3) Egg crate. (baffles)
(4) Circular mufflers.
(5) Manufactured sound traps.

Each must be specified to meet pressure loss and space requirements, in addition to noise reduction.

The architect's plans will determine the consulting engineer's layout of the system and show where space is available. From a noise reduction standpoint, the sound treatment should be as close to the outlet as possible. This is true for several reasons:

(1) In addition to fan and equipment noise, additional noise may be caused within the duct by excessive velocities, duct take-offs, and re-entry of noise through duct walls from noisy spaces through which the duct travels.
(2) Spaces with different requirements can be treated independently.
(3) No cross-talk between spaces.

In many cases it is preferable to install treatment closer to the source because of cost or space limitations. Economic and space consideration should be made at time of layout.

Where it is impossible to ascertain the ultimate use of spaces at the time of layout, the branch take-offs at each floor are the most advantageous position for sound treatment. Maximum pressure loss for the sound treatment is easily determined at the time of layout. This should be spelled out either on the drawings or in the schedule of sound attenuators in the specification.

Attenuation or noise reduction requirements should also appear in the specifications.

Approximate values of attenuation for various NC curves are set forth in Table 2.

TABLE 1—RECOMMENDED NOISE CRITERIA FOR ROOMS

Noise Levels to be Measured in Unoccupied Rooms

Type of Space	Recommended Noise Criterion Curve from Fig. 1	Computed Equivalent Sound Level Meter Readings Db
Broadcast studios	NC 15-20	25-30
Concert halls	NC 20	30
Legitimate theaters (500 seats, no amplification)	NC 20-25	30-35
Music rooms	NC 25	35
Schoolrooms (no amplification)	NC 25	35
Conference rooms for 50	NC 25	35
Apartments and hotels	NC 25-30	35-40
Assembly halls (amplification)	NC 25-30	35-40
Homes (sleeping areas)	NC 25-35	35-45[a]
Conference rooms for 20	NC 30	40
Motion picture theaters	NC 30	40
Hospitals	NC 30	40
Churches	NC 30	40
Courtrooms	NC 30	40
Libraries	NC 30	40
Small private offices	NC 30-35	40-45
Restaurants	NCA 45	55
Coliseums for sports only (amplification)	NCA 50	60
Stenographic offices (typing and business machines)	NC 50	60
Factories	NCA 40-65	50-75

TABLE 2—ATTENUATION REQUIRED AT VARIOUS FREQUENCIES

NC Curve	Octave Frequency Band							
	20-75	75-150	150-300	300-600	600-1200	1200-2400	2400-4800	4800-10000
	Attenuation Required, Db							
NC-50	6	8	10	15	25	36	29	22
NC-40	7	9	11	18	30	40	30	27
NC-20-30	9	11	17	26	45	56	46	42
NC-10-15	11	15	24	33	56	62	55	52

These numbers can be used as a guide. They are to be used with spaces listed in Table 1.

It is important to specify attenuations in decibels by octave bands to assure sufficient noise reduction over the entire audio band.

To be complete, the specification must also state the test method by which these values are to be obtained.

Unfortunately, there are no standards in the air conditioning industry for evaluating duct attenuators. Each method yields widely different values for the same treatment.

Several of the commonly used test methods are:

(1) Reverberant field insertion loss.
(2) Double reverberant room insertion loss.
(3) Duct end difference.
(4) Duct insertion loss.

Figure 2 shows the different values for two test methods using the same prefabricated trap.

The "End difference test method," described in the suggested specification appended to this article is the most practical and yields results which simulate actual

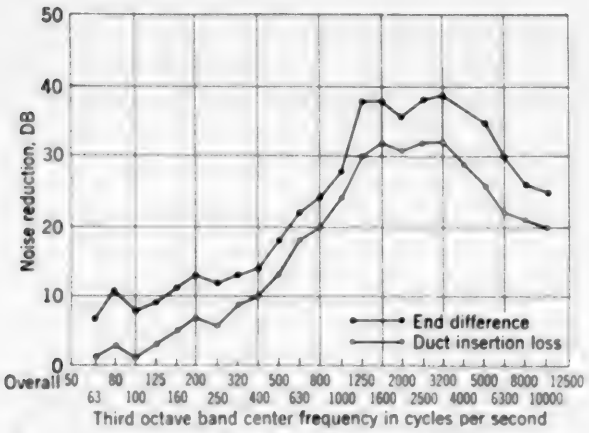
Noise reduction, DB
End difference
Duct insertion loss
Overall 50 80 125 200 320 500 800 1250 2000 3200 5000 8000 12500
63 100 160 250 400 630 1000 1600 2500 4000 6300 10000
Third octave band center frequency in cycles per second

Fig. 2. Comparison of results of duct end difference test and duct insertion loss test.

operating values. The desirable features of such a test are:

(1) Ability to provide accurate comparative ratings.
(2) Ability to provide absolute values of noise reduction which correlate accurately with performance results.
(3) Flexibility.
(4) Simplicity.
(5) Ease of reproduction by qualified acoustical labs and/or analysis.

Each supplier of sound attenuating devices uses a different method for rating his product. Therefore, from the manufacturers literature it is impossible to rank performance of one product with another.

By defining the method by which ratings are to be obtained, the engineer compels the manufacturer to show the effectiveness of his product in comparison to other products offered for the same service. Only then can he be assured that the contractor installs what he has intended in the specification at the most reasonable price available.

More information is known about the performance of manufactured traps than of any other duct attenuators. Attenuation of a manufactured trap varies with length only, generally speaking. In the case of lined duct or straight-through circular mufflers, attenuation also varies with the cross-section of the treatment.

It can also be said, in general, that a staggered baffle, sine wave path, or helical path will give better performance than a straight path. This is because when the line of sight is broken, sound is blocked. This is demonstrated in jet engine test cell intake and exhaust mufflers where a sine wave path is used extensively.

Therefore, it is important to be familiar with the construction of the proposed silencing method.

As most silencers for air conditioning work are the dissipative type, they use an absorbent material. The material must be light in weight and porous. Materials of this type erode easily in the air-stream. The specification should outline the protective barrier for the absorptive material to prevent such erosion with consequent loss of effectiveness.

A very complete specification form is appended here as a guide for the engineer. It includes all of the points brought out in this report.

SPECIFICATION FOR DUCT SOUND ATTENUATORS

1. Scope

This section covers furnishing and installing duct sound attenuators, complete.

2. General

Duct sound attenuators as hereinafter specified shall be installed where indicated on the drawings. The duct sound attenuators shall consist of an exterior casing with perforated interior face sheets backed with acoustically absorbent filler material. The exterior casing shall be provided with minimum two inch long extensions on each end for connection to ductwork. The attenuators shall be air tight when operating at an internal pressure of 8 inches water gage, or less, and shall handle this pressure without case distortion.

3. Materials

The exterior casing and perforated interior face sheets shall be constructed of galvanized sheet steel. The exterior casing shall be minimum thickness 18 gage and the perforated interior face sheets shall be minimum thickness 24 gage. Seams shall be commercial mastic filled lock type or be continuously welded type. Bonded inorganic matting shall be placed between any acoustically absorbent filler material and the perforated face sheets to prevent erosion of the filler. The acoustically absorbent material shall be inorganic (glass or mineral) fiber.

4. Acoustical and Air-Handling Performance

a. Duct sound attenuators shall be in accordance with the following schedules:

Sound Attenuation db. re 0.0002 Microbar
Octave Bands (cps)

37.5 to 75	75 to 150	150 to 300	300 to 600	600 to 1200	1200 to 2400	2400 to 4800	4800 to 9600

Physical Characteristics

Limiting Dimensions			*Air (Max.)*	*Pressure Loss,*
Width	*Height*	*Length*	*C.F.M.*	*In. W. G. (Max.)*

b. *Certification* of the acoustical performance of the duct sound attenuators as claimed by the manufacturer shall be submitted for approval to the Consulting Mechanical Engineer. Tests shall be made by a recognized independent acoustical laboratory as approved by the Consulting Mechanical Engineer. The testing procedure by the acoustical laboratory shall be as follows:

Sound attenuation herein specified shall be the difference in sound pressure levels measured one duct width from either end of the unit with a microphone placed on the central axis of the duct and oriented in such a manner that the sound waves are at a grazing incidence with respect to the microphone diaphram. The noise source shall be a random noise generator whose output shall be passed through a spectrum shaping one-third octave band equalizing filter, thence to a speaker system of which the output will produce a constant level per cycle which will exhibit a rise of three decibels per octave with increasing frequency. The loud speaker shall be located no less than three feet six inches from one end of the attenuator. No less than three feet six inches from the other end of the unit there shall be an "anechoic" termination.

All of the equipment, with the exception of the attenuator, shall be housed in a concrete duct so that the noise source and the termination wedge are acoustically shielded to prevent flanking. The attenuator shall not be acoustically treated externally. The joints between the material forming the walls of the duct, and between the duct and the attenuator, shall be sealed with an adhesive tape.

c. Certification of airflow capacities at maximum pressure loss as specified shall be submitted for approval to the Consulting Mechanical Engineer. These shall be made by a recognized independent laboratory (qualified to perform airflow tests) as approved by the Consulting Mechanical Engineer.

d. Certification of unit performances as specified shall be submitted to the Consulting Mechanical Engineer no later than thirty days after award of contract. Certification shall be of production units selected at random and similar to the units being offered and the manufacturer's affidavit to this effect shall accompany the laboratory reports.

NOISE CONTROL SYMPOSIUM

A research correlation conference conducted by the Building Research Institute brought the nation's outstanding experts on sound to New York early last year. Following are a few quotations from a 136-page manual of proceedings issued as BRI Publication 706.

"Acoustics involve both physics and psychology, and we cannot separate the two. . . . With the increased use of lightweight materials and the demand for flexibility and movability, we find many owners surprised when the building doesn't work acoustically. . . . Most (acoustical) mistakes made in buildings today come from just plain ignorance, neglect, or the lack of realization that every building has acoustical problems. . . . There are no black and white answers to acoustical control. We can't say that 30 decibels is good and 40 is bad, or any other number. . . . We have two very simple mechanisms of sound control at our disposal, absorption of sound and isolation of sound. Useful absorption of sound is provided by porous materials. . . . Sound isolation, on the other hand, which is the control of the transmission of sound from space A to space B, is governed almost entirely by the weight and other physical characteristics of the partitions. . . . We must remember that when we ask a partition to give us a noise reduction or a transmission loss of 40 decibels we demand that it transmit only 1/10,000th of the incident energy. . . . Any cracks or leaks can very quickly nullify the value of the good partition."—*Robert B. Newman, Vice President, Bolt, Beranek, and Newman.*

"Unfortunately, different writers have used the same terms . . . to label their selections (of acceptable sound levels) but they seldom state whether this is what they would like to achieve or what they estimate as just tolerable. The most comprehensive guide to acceptable noise levels is based on work . . . for the Air Force . . . later refined by Beranek . . . in the form of NC and NCA curves."—*Lewis S. Goodfriend, Lewis S. Goodfriend & Associates.*

"The discussion of types of noise and methods of rating them is not complete without calling attention to basic types of control which exist. We have heard the remark, 'To quiet a noise—go to the source.' . . . but we cannot go to the designer (who) does not understand fully why his equipment makes noise. Certain alternatives, however, do exist, and these can be categorized in five key words: *Specify* quiet equipment. *Shield* the equipment by . . . massive . . . wall structures. *Attenuate* the noise . . . between the source and the listener. Reduce (reverberation) by the use of *absorbtive* materials. Utilize the *distance* concept—i. e., remove the source as far as possible from the listener."—*C. J. Hemond, Jr., University of Hartford.*

"In summary (of a paper giving design procedure and data for control of ventilation noise), after the design goal has been set, the general technique used in engineering the system is to take the sound power contributed by the various noise sources and to compute the sound power which arrives at a particular working space. Knowing the acoustical characteristics of this space, one then computes the sound level and compares it with the design goal. One can then decide what noise control measures will be necessary to obtain the required noise environment."—*Howard C. Hardy, Howard C. Hardy and Associates.*

"With present day high velocity systems, these (sound attenuators) are an essential part of an installation which must give quiet results. The particular types of construction described in this (sample) specification have worked well in practice, but it will be recognized that there are many other types available today, including various manufactured attenuators designed to be installed . . . at the job. . . . The choice is primarily an economic one: Which method of achieving the desired acoustic results will cost least or take least space under practical job conditions."—*Alfred L. Jaros, Jr., Jaros, Baum & Bolles, Engineers.*

What the Air Conditioning, Heating, and Ventilating Design Engineer Should Know About

Industrial Building Operators' Problems

The objective of this experience outline is to point out various features which might be considered in the design of new industrial buildings or modernization of existing facilities. It is really the owner's "point of view" and may broaden the engineers' horizon by presenting successful considerations regarding mechanical facilities for industry.

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EVERYONE INVOLVED in design and operation of industrial plants must focus keen attention on the functional and flexibility aspects of plant facilities if we are going to keep pace with our present-day inflationary economy. We must see to it that facilities dollars do make their fair contribution to increased productivity and profit, so mandatory to long-range industrial survival. Further, we must never forget that a proper balance between facilities and the over-all well-being of employees brings about top efficiency.

After working with more than five million square feet of industrial facilities at General Electric's Appliance Park, it is our experience that the day for justification of industrial "monuments" has long since passed, because obsolescence of facilities happens much faster than we realize. We sincerely believe that only the most functional facilities serve the real intended purpose. Appliance Park is only about nine years old, and while it represents the most modern industrial design thinking, it has already been a proving ground for many features which would not be repeated. Mechanical services, including heating, ventilating, and air conditioning are too often accepted as a necessary part of a building rather than a direct productive tool related to application opportunities.

Based on our experience, the basic building need be only a shell, with the mechanical facilities kept in abeyance until the occupancy objectives are established. Taking utilities services piping as an example, we found that our design idea of installing only primary portions of these requirements paid great dividends. The plant site as a whole was designed and equipped with loop type layout, and this same theme was followed inside the major buildings, with the secondary distribution system deferred until the plant layout needs were established. The result of this action was a substantial savings in initial cost and now, five to nine years later depending upon the age of the individual building, there is much fully utilized manufacturing space still not equipped with the secondary type installations we would have had in place if the old conventional plan of equipping a building had been used.

In reverse of the design criteria used for most of the utilities services piping systems, multiple sewers for various types of discharge effluent have proved to be a heavy contributor to a water and waste management program which, over all, is presently saving Appliance Park approximately $250,000 per year. The multiple sewer system consists of separate lines for sanitary, storm, rinse type wastes, chrome, and cyanide, all installed on a simple grid pattern to the degree necessary for adequate building coverage. While we believe that the long-range dollar savings potential has barely been approached, the reuse of uncontaminated storm water in our mill water system, the use of spent acid as a treating constituent for mill water quality improvement, plus many similar diversification features in the handling of contaminated industrial wastes have proven beyond doubt that our scheme of functional isolation was well worthwhile and will show tremendous contributions in the years ahead.

The area of heating and ventilating has provided us with experience that now dictates quite a radical design change in the handling of our type of high-level industrial buildings. For the early constructed buildings, we used the conventional recirculating high-mounted unit heater to care for the building's actual heat loss and augmented this system with numerous reasonably small capacity fresh-air make-up units, sized to provide a positive building pressure when balanced against process exhaust requirements. These units were equipped with air filters and located in the

truss space with air intake through the roof. Our operating experience shows that the pressurization idea was sound but that the small-capacity, isolated units were too costly to maintain, and much of their purpose was lost because of our being unable to satisfactorily deliver the fresh air to the worker zone at desired temperature. These troubles proved to be serious objections. Heat gain from sun on the roof in the summer, air mixing effect by stratification situations, plus numerous process equipment interferences were typical problems fought. In addition, we found that recirculating unit heaters were unnecessary away from the outside walls of our large buildings.

Later major building construction included minimized use of recirculating unit heaters with large capacity air make-up systems replacing the numerous isolated smaller units. The reduction in maintenance and improved performance were very definitely worthwhile achievements.

Unfortunately, the real objective of providing worker comfort and reasonably clear factory air was not fully accomplished, and we considered a broader departure from conventional methods for any new facilities as follows: (a) heat loss for high-level buildings would be calculated with recognition of a worker zone elevation of only 20 feet or less; (b) ventilation would definitely be by large unit stations located entirely on the roof with air discharge down to the worker zone level or a combination of large units for the internal areas and smaller package units located at worker zone height through the exterior walls. Process heating and ventilation requirements would be handled strictly according to individual need, and we would not attempt to make these part of the building design; (c) we still advocate the pressurization theme but would put more emphasis on a minimum of at least four air changes per hour, plus matching process exhaust. We have used these criteria for many later facilities with no initial cost premium over other so-called conventional methods, and in many cases an operating cost reduction has resulted.

Air Conditioning

On the subject of air conditioning, we are convinced that the package type design approach offers advantages which must be considered, instead of plunging ahead and considering only systems of most conventional design. Again, based on our experience with well over five thousand tons of installed air conditioning, worthwhile evidence can be presented to show that the design theme, "air condition according to established need," is more practical than the philosophy of setting design according to possible use and considering building shape, size, and projected planning. We have large central type systems, central/zone sectionalized systems, package type unit systems, and many individual isolated package unit applications. Each type of system does have a place in the field. Based on the comfort reactions of all building occupants along with process requirements in some spots, the fact can be accepted that all of our various type systems are doing a satisfactory job. Air movement in the buildings varies from 12 changes per hour with some of the central systems, down to approximately five changes per hour in large areas that are handled entirely by the self-contained package type equipment. Fresh air make-up is in the range of one change minimum to two changes maximum, the requirements depending upon the system installed. A few important results are as follows:

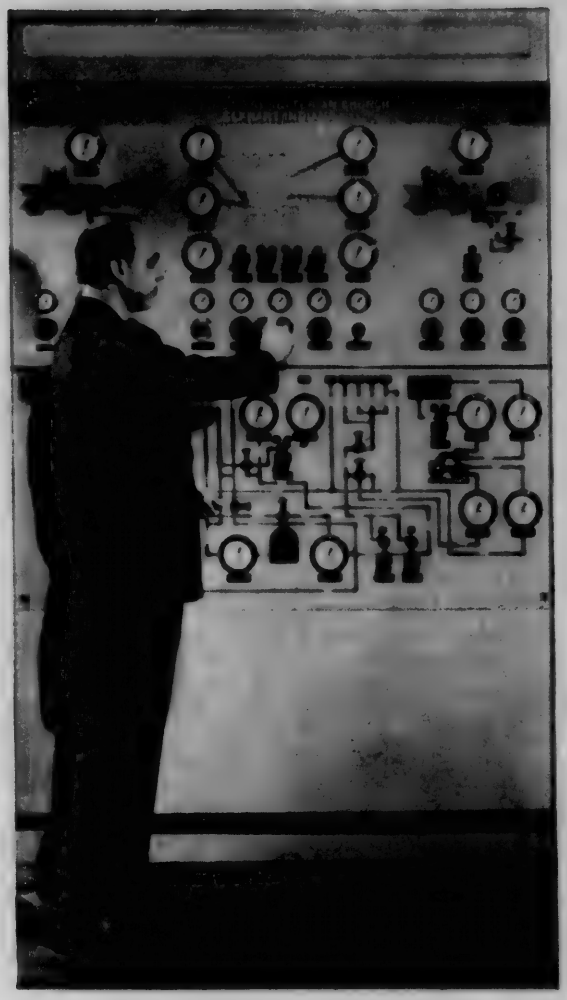
(a) For strictly comfort conditioning, one of our typical office buildings would have required a 500-ton central system, but we elected to install 380 tons of strategically located package type equipment. The initial cost savings were quite important, and we have found that the building maintenance cost on an annual basis is approximately $5.00 per ton less than an identical building with the central system, and operating cost is lower by approximately $3.00 per ton on an annual basis. The whole reason stems from the fact that people like different temperature conditions, and we are not wasting any tonnage.

(b) For combination comfort and process requirements, we again have both central and package type systems. In these situations, we find that we can wholly justify the extensive duct layout and close-tolerance controls in many places, because, quite often, very close limits for both temperature and humidity (plus other important requisites) may require extremely high air change as well as moisture removal to the point where individual units would be most awkward. Further, we have many installations where straight air conditioning could justifiably be supplemented with absorption equipment to gain perfection in atmosphere control.

We do believe that the owner's dollars can be spent to best advantage if "shortcut to comfort by packaged air conditioning units" is considered for the right application and then a more thorough approach given to those jobs which really need central or specialized systems. True comfort can be measured only by the conditions that will satisfy the end use of the area to be conditioned.

Our opinion of important "pay dirt" design fundamentals would be to (a) keep the basic building structure strictly functional and take the resultant cost savings to apply against all phases of building service feature requirements. Again, concentrate on an adequate primary service system but install secondary phases only where the definite need is known. (b) Do not design to have service features accommodate the whole building but work entirely around the intended occupancy requirements. (c) Use a "balance sheet" approach in justification of all revolutionary building service features, because this will enable management to give proper evaluation and measure results in the years ahead. (d) Always locate facility type equipment in accessible spots and be sure that simplicity and minimum long-range rearrangement interference are considered.

With the fast changing industrial needs of today, we hope to continue to design and build our facilities in a way to achieve even more functional flexibility without the loss of efficiency, and we are convinced that we can continue to make an important contribution to profitability by keeping good cost control on this type of capital investment need.



DESIGN OF PNEUMATIC CONTROL CENTERS

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The knottiest problem in connection with design of control centers is to determine how much supervision and control is warranted. After explaining the basic components of the pneumatic system, the author considers the criteria of budget, comfort standards, and convenience in the lay-out of a control center for a typical small office building.

AIR CONDITIONING, HEATING AND VENTILATING'S REFERENCE SECTION

PNEUMATIC TRANSMISSION has long been accepted in the process industries as a simple and dependable method of accomplishing remote indication and control of temperature, pressure, and other variables. It is now established in the field of comfort heating and air conditioning.

While the principles employed are not new, considerable ingenuity has been required to make this type of equipment economically feasible in the commercial field. Much of the impetus to adapt the equipment comes from the trend toward centralization of controls and operating information on large air conditioning jobs. This has resulted in production of this type of equipment in the quantities necessary to realize economical production.

Transmitter, Transmission Line, and Receiver

Pneumatic transmission starts with the conversion of temperature, humidity, pressure, or other variable into a suitable pneumatic signal by a device called a *transmitter*. The pneumatic signal is fed into a *transmission line*, usually ¼-inch OD copper or plastic tubing run along the most economical route. At the end of the transmission line is the *receiver* which converts the pneumatic signal into the movement of a dial, a pen, or a control mechanism, depending upon whether the receiver is of the indicating, recording, or controlling kind.

The pneumatic thermostat seen in most commercial and public buildings is a good example of the pneumatic transmitter, and the most well known because temperature is the most common subject of transmission. However, the principles that apply to thermostats and temperature transmission apply equally to other variables.

Conventional pneumatic thermostats measure temperature with bi-metal elements or liquid-filled bellows which actuate air pressure reducing valves. Pneumatic signals are thereby initiated, proportional to the measured temperatures. A pneumatic signal, called a control pressure, actuates a pneumatic valve or damper operator to correct any deviation in the temperature measured from that at which the thermostat was set.

In order that relatively small deviations in temperature may be sufficient to actuate the corrective control mechanism, it is necessary that the thermostat produce a relatively large pressure change for every degree change in temperature. Thus, the thermostat will convert a change of only a few degrees in temperature into a pressure signal change from, say, 3 to 15 psi.

The Principle of Negative Feedback

While the thermostat functions over a very small temperature range, most pneumatic transmitters must use their ranges of air pressure sparingly, as they are required to function over a wider temperature range. A typical room temperature transmitter, Fig. 1, transmits a pneumatic signal of 3 to 15 psi over a temperature range of 50 to 100 deg F. This amounts to less than ¼ psi per degree. The small movements and forces required to produce this very low rate of pressure change would make it quite difficult to obtain the accuracy required. Any lost motion or friction would

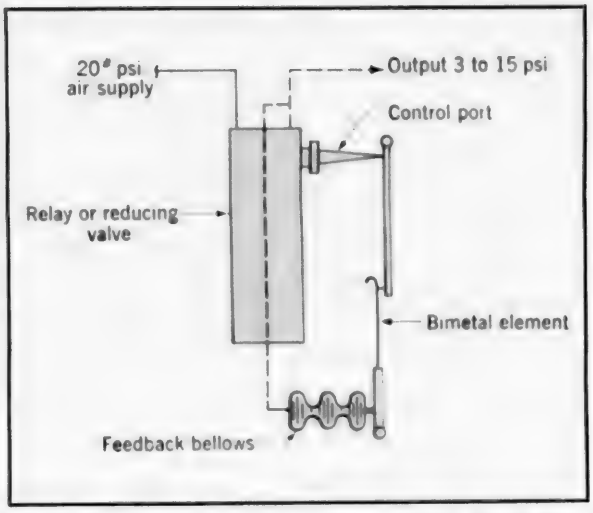


Fig. 1. Side view of a room temperature transmitter.

be proportionately much larger than in the thermostat described previously.

To eliminate this difficulty, a principle known as negative feedback is used. The bi-metal element of Fig. 1, which actuates the control port and regulates the output pressure of the transmitter, is purposely made to produce a large pressure change per degree change in temperature. But the output pressure is connected to the feedback bellows which is arranged to produce a motion of the bi-metal element opposite to that caused by the temperature change. The net effect is the difference between the motion caused by the temperature change and that caused by the feedback bellows.

Besides eliminating the need for using extremely small movements, negative feedback provides a continuous balance between motion caused by changes in temperature and motion caused by resultant changes in the output pressure, assuring an accurate relationship between the two.

Transmitters for measuring the temperature in a pipe or duct are similar in principle but utilize a remote bulb thermal system and have temperature ranges suitable for the various applications for which they are used.

The Pneumatic Thermometer

Receivers for temperature indication are simpler devices. In fact, the most used receiver, or pneumatic thermometer, is a high quality, accurate air gage calibrated in degrees rather than in pounds per square inch. If the transmitter produces a linear signal from 3 to 15 psi over a temperature range of 50 to 100 deg, the gage merely has to be calibrated to read 50 to 100 deg over this pressure range. Figure 2 is a drawing of an indicating receiver or pneumatic thermometer.

A controlling receiver also is a relatively simple device. It is used in conjunction with a pneumatic thermometer when a control function is to be performed. It is, in essence, nothing more than a controller that is responsive to pressure changes. It receives the pressure signal which represents temperature changes at

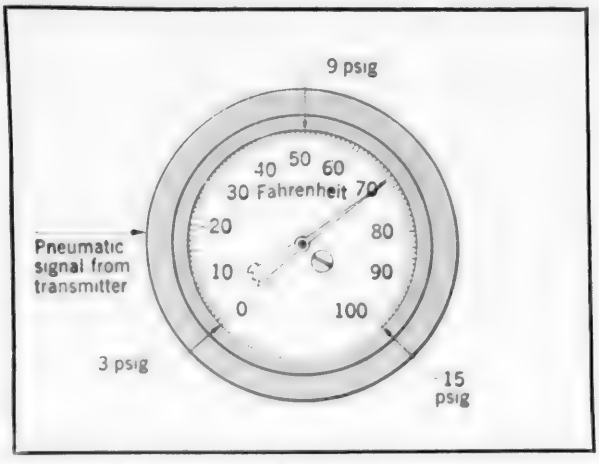


Fig. 2. The pneumatic thermometer is an air pressure gage with scale divided into degrees of temperature.

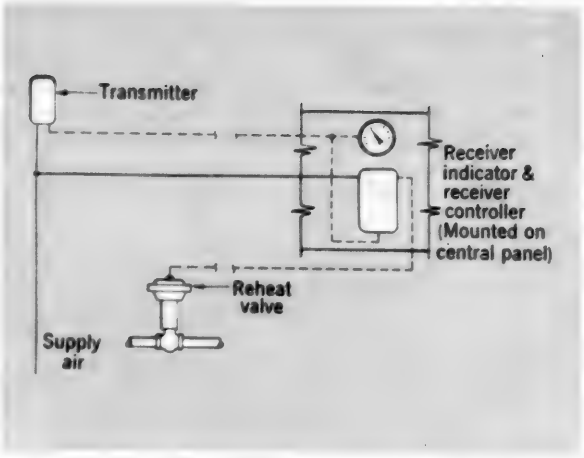


Fig. 3. Hookup of a complete indicating and control arrangement. Possible variations are limitless.

the transmitter, and converts it into a varying control pressure suitable for operating pneumatic valves, damper operators or other controlled devices that affect the temperature at the transmitter. Unlike a conventional pressure controller, its adjusting dial is calibrated in degrees to match the temperature range of the transmitter. It must, of course, have a throttling range, or sensitivity adjustment, to match its response to that of the system being controlled.

This receiver controller may take many forms to accommodate any type of control system. It may be used as a conventional controller, as a high or low limit control, as a wet bulb or apparatus dew point controller, or as a master or a submaster. Other functions, including recording, are also available. From the standpoint of the receiver controller, the transmitter is merely its measuring system—its intelligence—just as the conventional bi-metal element or remote-bulb system is the intelligence for the conventional temperature controller. Transmission between measuring point and controller is done by air rather than mechanically or by transmission of gas or liquid pressure. Figure 3 shows the hookup of a complete indicating and control arrangement.

Control Centers

Centralization of indication and control of building heating and air conditioning systems is helping to bridge the gap between the ever increasing complexity of current systems and the shortage and high cost of properly trained operating and maintenance personnel. Central indication of important operating data, suitably displayed on a graphic representation of the equipment and systems involved, can produce a pride in operation and an understanding of the system by the operating personnel not previously possible.

A central control simplifies day-to-day operation, permits closer supervision of conditions with consequent greater occupant comfort, and releases personnel for more preventive maintenance work. It can increase the area of supervision of any group of personnel.

Centralization of operating data can be done with vastly varying degrees of completeness. Any installation would seem to warrant some centralization—the bowling alley or shopping center maintenance man or manager can profit from at least an indication of space temperatures in the major area of his concern. The most complete centralization of data (temperatures in each zone, each fan system dew point, return air, fan discharge, chilled water in and out, converter supply, etc.) is probably restricted to the larger, more complex plant. However, some utilization of the control center idea seems justified in almost any installation.

A Simple Control Center

The simplest control center would consist of a few pneumatic thermometers, grouped logically on a panel. Each of these thermometers would be fed with a temperature signal from a transmitter located at the proper point, using the transmission principles already discussed. To better understand the system, the simplest of graphic representation might be used—an outline of the building with the pneumatic thermometers located in this outline at the points of temperature measurement. Figure 4 shows such a control center.

Even for smaller jobs, recording of important temperatures can be provided economically. Usually it is not necessary nor desirable to record all temperatures. This merely results in filing cabinets full of unused

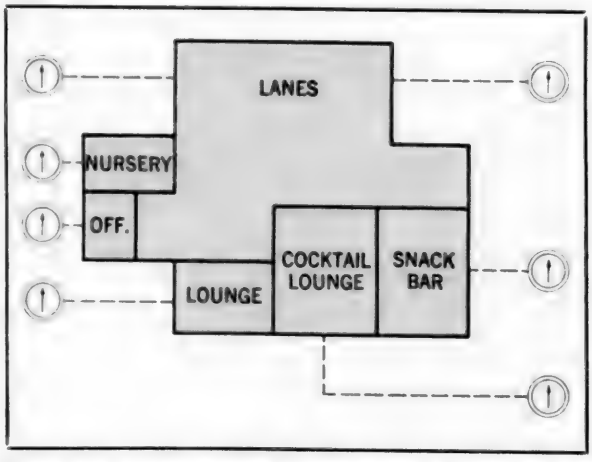


Fig. 4. A simple control center for a bowling alley.

information. A single miniature recorder, only 6 inches square, but with the same chart area as the conventional old style recorders, can serve a group of transmitters. Each transmission line has a plug-in fitting permitting the recorder to be connected to and record any one of the temperatures. Records for five minutes to thirty days can be obtained on a single chart without interrupting the temperature indication of these or any other points. Two-pen recorders also are available if two simultaneous records are desired.

A plastic hose attached to the recorder, as shown in Fig. 5, allows random plug-in recording of any trouble spot.

For further simplification of operation and observance of the system, pneumatic thermometers may be equipped with set point indicators—adjustable red pointers on the dial face. These enable the operator to tell at a glance when any temperature deviates from the desired value. Any indicating pointer protruding from under the set point indicator, as in Fig. 6, will catch the eye.

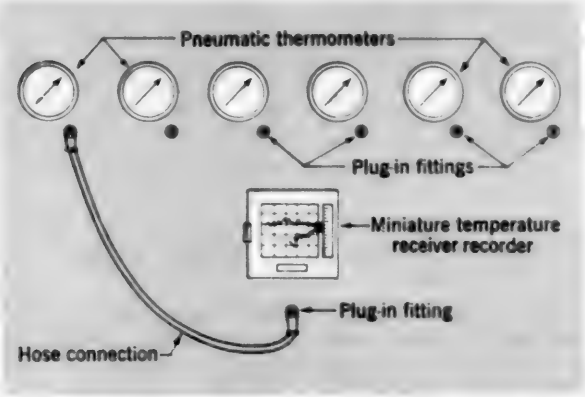


Fig. 5. A plastic hose attached to recorder at control center allows plug-in recording of any trouble spot.

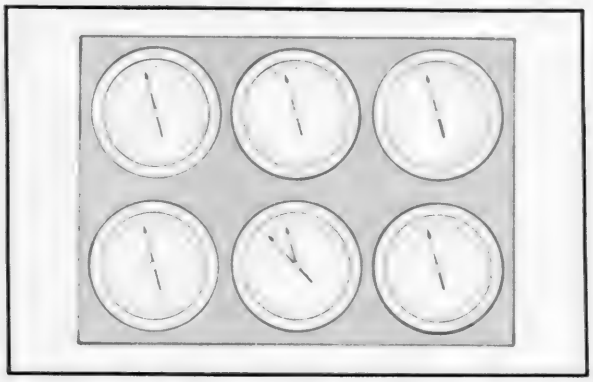


Fig. 6. When thermometers are equipped with set-point indication, area off its set point is spotted at a glance.

Schemes for Larger Systems

Expanding the simple control center to accommodate larger installations allows one to give vent to his imagination. Many feel the most obvious addition is a means of re-setting, from the panel, the temperatures being indicated. In many cases this is true.

For the conventional interior building area, however, a temperature setting, once established, is probably better left alone. This is the consensus of opinion of a number of building engineers. People are usually in these areas eight hours a day, five days a week, become accustomed to a particular temperature, and seem to like it that way. Remote reset also should not be used to correct temperature deviations resulting from faulty functioning of the system. When something is wrong it should be personally investigated.

Remote reset of temperatures does have a use in public spaces or other areas with varying or intermittent occupancy. It is very useful for pre-cooling auditoriums or other spaces used for large gatherings. Apparatus dew point temperature or other temperatures that require seasonal or occasional adjustment to maintain the desired space conditions may also benefit from remote adjustment.

Many buildings have a peripheral system of some sort which allows some manual readjustment of temperature by the occupant. However, where this is not so, or in various types of public buildings equipped with exterior zone control, central reset of temperatures to compensate for outdoor changes is worthy of consideration. Figure 7 shows a transmission system including remote manual set point adjustment.

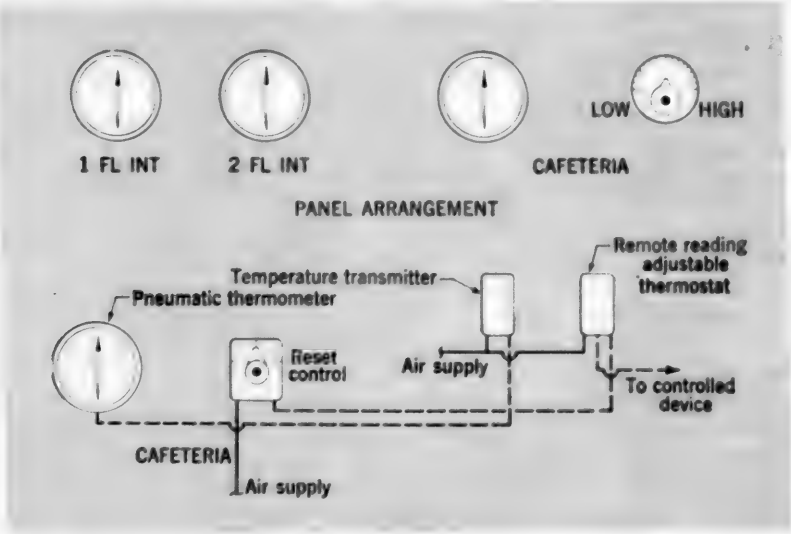


Fig. 7. Panel arrangement and diagram for reset of temperature from the control center.

Graphic Layouts

Other additions to the control center may be in the form of graphic layouts of various fan and pump systems with temperature indication and remote reset at strategic points. Graphic diagrams may be added at varying cost. Perhaps the least expensive involves the use of a series of plastic symbols depicting fans, pumps, valves, dampers, etc. These symbols are properly arranged to match flow diagrams and glued to the face of the panel. More elaborate graphics may be painted reverse engraved in lucite, or otherwise laminated to the face of the panel.

Pilot lights, start-stop pushbuttons, alarm and annunciator systems, slide projection systems illustrating various elements of the installation, and various automatic data logging systems may be incorporated into the most complete control centers.

Control of Electric Devices

For a number of reasons many functions that are normally electric are sometimes accomplished pneumatically on control centers. The multiplicity of air lines involved leads to the use of multi-tube bundles of copper or plastic tubing in plastic or flexible metal protective sheaths. Such bundles are available with as many as thirty-five ¼-inch tubes in continuous lengths up to 1000 ft. It is a simple matter to provide a few extra tubes to accomplish the normally electrical functions as starting and stopping of fans and pumps, actuating signals, alarms, etc.

To start an electric motor, Fig. 8, a pneumatic pushbutton switch at the control center is connected by tubing to a pressure actuated electrical switch at the motor starter. A target gage, located adjacent to the pushbutton, shows red when the motor is running and green when it is stopped.

To actuate a signal indicating an electrical operation at some remote point, Fig. 9, an electrically actuated air switch (solenoid air valve) is connected by tubing to a target gage on the control center.

These arrangements permit all control center functions to be done pneumatically without the need for conduit and wiring between the control center and the apparatus. Divided responsibility for the installation is avoided, and in many cases at a reduced cost. Where explosive hazards exist this all-pneumatic arrangement is particularly attractive. In such cases even the chart drives of recorders may be pneumatic.

DESIGN OF A TYPICAL CONTROL CENTER

A typical small office building might consist of a semi-occupied basement, ground floor, and second and third floors, all devoted to general office space, with a few partitioned private offices and one EDPC (computer) room. It is heated by peripheral radiation fed from a hot water boiler.

Further, winter ventilation and summer air conditioning is supplied by several conventional air conditioning systems equipped with modulating fresh air, return air, and exhaust air dampers, a preheater, cooling coil, supply fan, and multiple zone reheat coils. Refrigeration is provided by two centrifugal refrigeration machines with the usual condenser water and cooling tower arrangement.

The building is approximately 300 x 100 ft; each floor is divided into eight zones, each with its own reheat coil fed by the central air handling apparatus.

It is first decided that the owner will employ at least one qualified watch engineer, but it is likely that the other operating and maintenance personnel will have a far less complete education and be less experienced. Comfort of the building occupants is judged important by management, and a basic decision has been made to incorporate a simple form of control center in the base specification.

How Much Control Is Warranted?

Given the foregoing conditions, and a limited budget, the following reasoning would be likely:

Because occupant comfort is considered the most important, there should be indication of temperature in the various areas of the building. The number of such points is the question. To have more points than there are zones is unwarranted, since any temperature deviation discovered in areas not equipped with temperature control could be traceable only to air distribution, something not at all indicative of maintenance or operational trouble.

To have less temperature indicating points than there are zones of conditioning control would force a decision as to which zones are the more important. In the present case, with all space in the building devoted to general office use, the choice would be a difficult one.

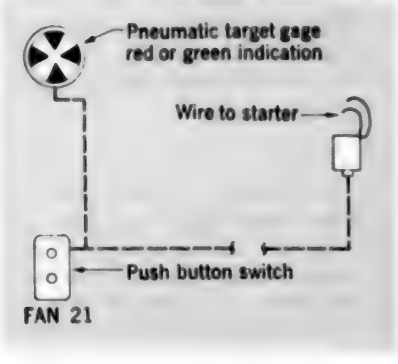


Fig. 8 (left). Pneumatic fan or pump starting, one of many optional auxiliaries to a pneumatic control center.

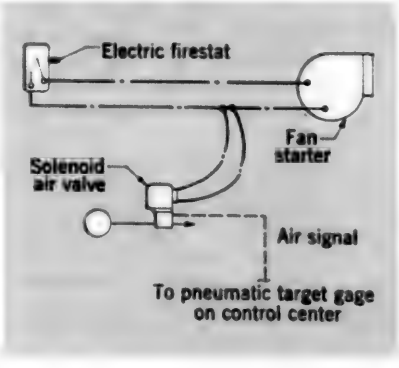
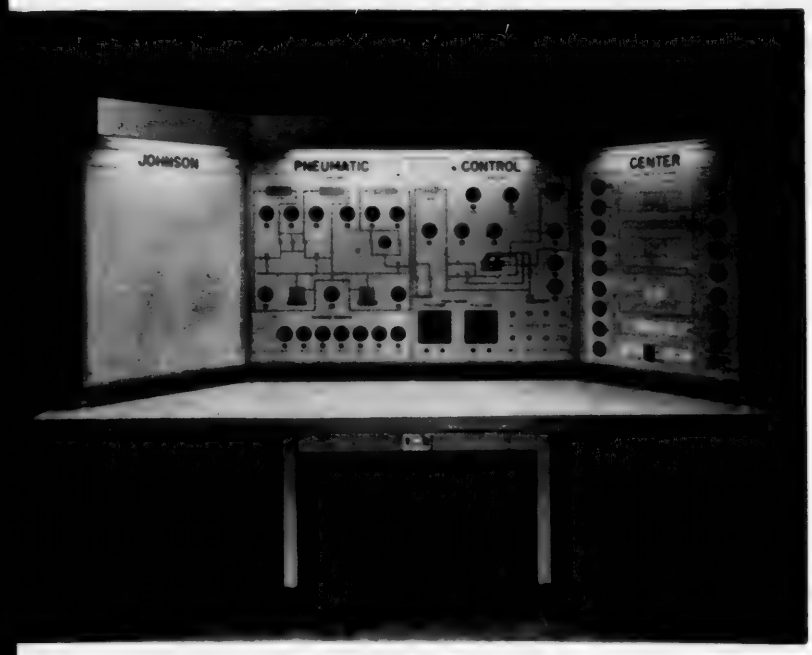


Fig. 9 (right). Pneumatic alarm indication is another optional auxiliary to a pneumatic control center.



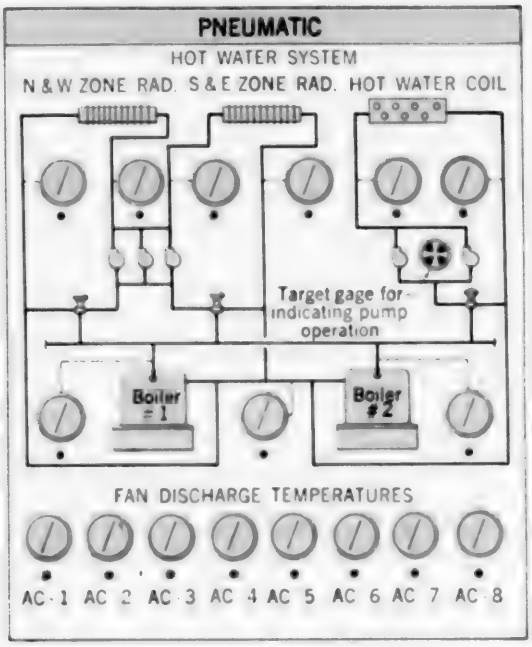


Fig. 10. Control center for a small office building. Photo shows panels before mounting

However, in this particular building there are thirty-two zones of reheat control. Thirty-two points of indication of room temperature for a building of this size would be stretching the budget more than could be readily justified. An analysis of the floor plans indicates that, although there are thirty-two zones, largely due to exposure problems, most floor areas are wide open. Thus, temperature trends can be picked up by half the number of points, with transmitters located centrally between two zones. This is not always a valid compromise solution, especially if partitioning or occupancy or exposure makes certain zones quite different in heat loading than in some adjacent zones.

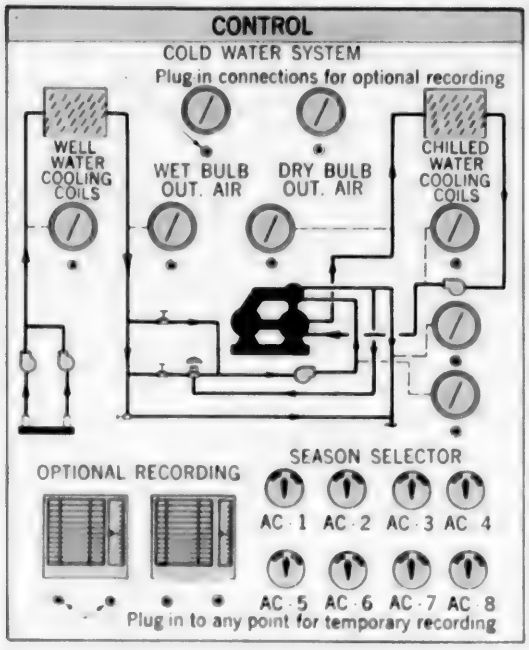
To further complicate the problem, many buildings are equipped with a great number of zones in the form of individual office under-window units or mixing boxes. A sensing point in each would result in a very great number of points on the control center. However, it is found that, where air conditioning facilities are broken down into almost individual-office control, the value of remote temperature reading diminishes. Occupants of these spaces can be allowed to adjust their thermostat settings themselves and thereby satisfy their comfort requirements without attention by building operating personnel. The occupant quickly becomes aware of deviations from the set point and can generally be counted on to monitor his own temperature condition. This is not generally the case with larger office areas, and it is the latter type of zoning which provides a basis for central temperature surveillance by the operating personnel.

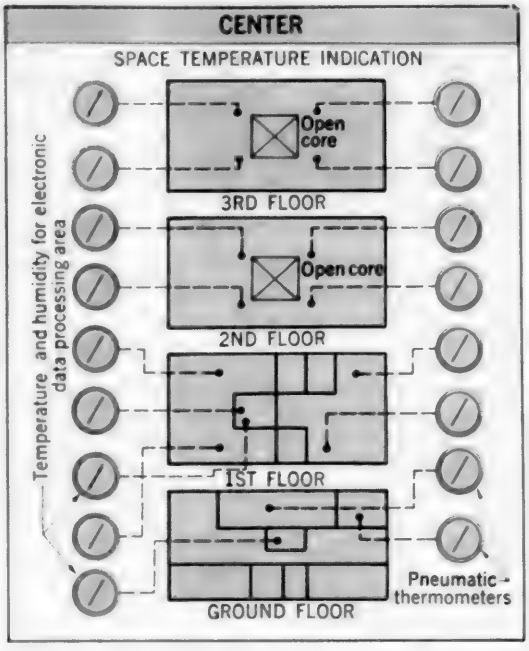
Therefore, it is decided to provide remote reading of temperatures in sixteen typical office areas. In each of these there will be installed a room type temperature transmitter which will sense temperature, convert it into an air pressure signal, as previously described, which signal will be transmitted to a pneumatic thermometer on the control center.

Provide Remote Readjustment?

Whether or not to provide remote readjustment of the set point of the temperature being maintained in the sixteen office zones must be decided. The bases for this decision were discussed previously, and since these are typical interior office areas, it is realized that remote reset would not produce any advantage. *Remote temperature reset does not correct trouble. If the indi-*

R. J. Caffrey graduated from Yale in 1948 with a degree in Industrial Engineering. The following year he joined Johnson Service Company and is now a senior sales engineer in its New York office. He assisted in the design of, and supervised the engineering of, control center installations in the Arrivals Building of Idlewild Airport, the Union Carbide Corporation office building, and numerous New York Telephone Company installations. On the National Speakers list of ASHRAE, he also holds membership in the National Association of Power Engineers.





of instruments, for greater clarity. Diagrams illustrate the three instrumented panels in photo.

cation system spots trouble, the only solution is to send a man to the area to check on it.

Indication for Air Handling Equipment

What further points of indication should be provided for the air handling equipment? The temperature after each reheat coil could be shown by another thirty-two thermometers on the control panel. This might be done where maximum supervision from the control center is required, but normally the performance of the reheat coil would be checked by the maintenance man upon discovering that the room temperature is off normal limits. Since he must go up to the space to make this check anyway, he can check reheat discharge temperature at this time. Therefore, in view of budgetary restrictions, the thirty-two extra points of indication might not be justified.

Indication of Fan Discharge Temperature

Inclusion of indication of temperature of discharge of each supply fan should be included. This enables the operator, upon seeing that a room condition was off, to check the respective fan discharge and ascertain whether the trouble was at the central equipment or not. If the central fan was at fault, he would save himself a trip to the occupied space.

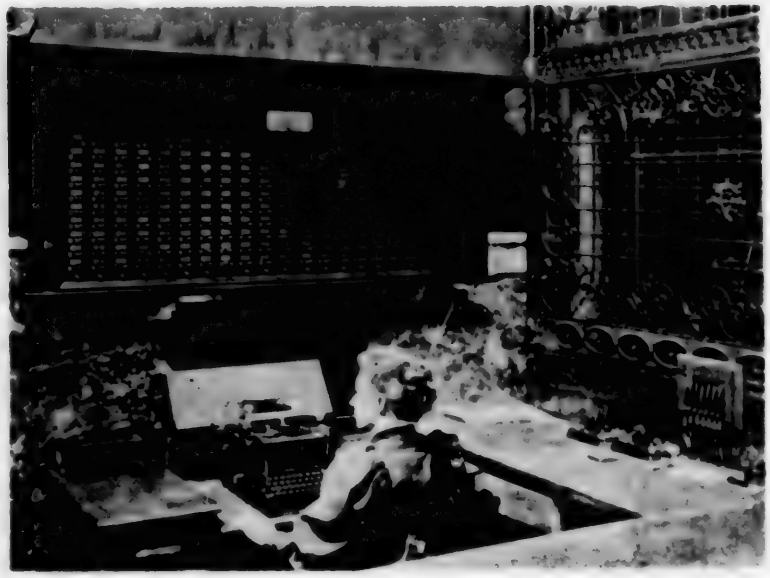
A further decision must be made as to whether other fan data, as mixture temperature, preheat discharge temperature, or cooling coil discharge temperature are of sufficient importance to include in the remote indication program. Decisions are based somewhat on the location of the fan equipment. If it is necessary for the operator to make a long tour of the fan system to analyze performance of the fan, such indication would be justified. Where humidity is an important factor, cooling coil discharge temperature or dew point should be included. In the immediate case, since fans are located on the same level and fairly near the control center, it is concluded that indication of fan discharge temperature alone will suffice.

Central Heating and Cooling

Figure 10 shows what points on the central heating and cooling system were selected. Individual preference plays an important role in this area. The points that are shown in Fig. 10 were selected as the minimum facility to give the operator a feel of the operation of his central heating-cooling water system.

Note that the "season selector", or summer-winter switches, are also included on the center. This is quite common, since, despite its name, the summer-winter switch is thrown many more times than twice a year. In the intermediate seasons, it is quite common to require cooling and heating alternately within the same day. Centralizing these switches helps assure proper attention to switchovers by eliminating the chore of traveling to the switches. Economy of operation can be reflected in such switching and direct return on investment can be realized from this part of the control center.

There are many additional items that might be added to the center. These additional points are best agreed upon at a meeting of the consulting engineer with the owner and control manufacturer.



▲ HAPPY 75th ANNIVERSARY to Johnson Service Co., Milwaukee, Wis., the company responsible not only for such sophisticated control centers as the console type shown above, but also for the 1890 temperature control installation shown at right. Then the world's most modern hotel, Milwaukee's Hotel Pfister was described in a souvenir booklet as follows: "The Hotel Pfister is supplied as follows: "The Hotel Johnson System of Heat Regulation. By means of this system the steam valves in each room are automatically controlled by the means of a thermostat placed upon the wall . . . The temperature of the room may be set at any particular degree desired by the guest, and relieves both the guest and the hotel employees of any responsibility. The temperature is usually set at 70 degrees, and is kept at that point automatically without any attention from anyone. Not only is the heat controlled by the thermostat in the room, but, by means of a switch-board in the office which is cared for by the young lady attendant, the heat may be shut off from any room in the building, without moving from the office."

Picture Paragraphs

▲ PRETTY SHIRLEY TAITT holds copies of "You and Public Relations," newly-produced booklet which the Consulting Engineers Council, of Springfield, Ill., is distributing nationally to members. The 16-page booklet was written to show how important good public relations are for the consulting engineer and how they can be attained with regard to his clients, his employees, and the public at large.

◀ THE "INSIDE" UNIT of a split-system unitary air conditioner is installed in one of the specially-constructed test rooms at Electrical Testing Laboratories, New York City, prior to being tested under the "random test" provisions of the 18-month-old Unitary Air-Conditioner Certification Program of the Air-Conditioning and Refrigeration Institute. The condensing unit will be installed in an adjacent room and both units will be tested under conditions specified in ARI Standards to assure that they meet the capacity ratings shown in Directory of Certified Units.

SPECIAL REPORT

EDUCATIONAL AND ECONOMIC EVALUATION OF SCHOOL AIR CONDITIONING

A school teacher, a school superintendent and an architect-engineer present the case for air conditioning public schools from their three different viewpoints, including the results of two extensive surveys. This Special Report is excerpted from papers presented at a seminar on Improving the Learning Environment, concerned with the effect of air conditioning on both pupils and teachers, sponsored by Carrier Corporation and held in New York City, June 29.

EFFECT OF SCHOOL ENVIRONMENT ON TEACHER AND STUDENT PERFORMANCE

EVA G. McDONALD
Teacher, Public School System, Alton, Ill.

Results obtained when teaching in air conditioned and non-air conditioned classrooms. Survey reports on comments by teachers and school administrators in other cities.

LIKE other teachers in Alton, Ill., I became interested in the effect of air conditioning on the classroom environment when I learned in 1956 that the Eunice Smith School, then under construction, would be completely air conditioned. When it was finished in 1957, I moved in with a class of sixth grade gifted children which I had been teaching the previous year. At the conclusion of the year, my students moved on to secondary school. I took over a fourth-grade gifted group, but again in an older school. Thus I had the experience of changing from an uncontrolled to a pleasant climate and back to an uncontrolled one again. In some respects the second move provided even sharper evidence than the first.

To find the answers, I interviewed some 150 teachers, administrators, supervisors, board members and interested city personnel connected with air conditioned schools in San Angelo, Texas, and Hobbs and Roswell, N. M., as well as in Alton.

They included teachers from kindergarten through senior high in both public and parochial schools. I asked the teachers to fill out a questionnaire, then add information which was pertinent but not covered in the questionnaire.

My discussion is based on the results of this research and my personal experience in Alton. Following are portions of the total environment which seem important and on which I will report. Most of them are interrelated.

1. Comfortable seating in a room of adequate size and shape.
2. Control of lighting and the visual environment, including elimination of outside distractions, use of attractive color schemes and adaptability to audio-visual techniques.
3. Control of noise and sound.
4. Control of the thermal environment and the cleanliness of the air.

The air conditioned schools I have seen, use a wide variety of window arrangements. Some schools such as Eunice Smith in Alton have the usual windows with venetian shades, supplemented by skylights which can also be covered. The windows are kept closed during the heating and cooling seasons. Others such as Travis in San Angelo have small windows up high which prevent the children from being distracted by outside events. Next we see the newest trend: no windows at all. Del Notre and El Capitan in Roswell, Highland Junior High and St. Helena in Hobbs exemplify this development.

As for visual aids, the schools with few or no windows are a joy to the teacher. The usual 10 to 15 minutes are not needed to adjust blinds or arrange the children and set up the screen. Instead a screen is installed near the ceiling of each classroom. With a "flick of the wrist" the screen is down, lights are out, and any type of visual aid such as slides, movie, or projector, is ready for use. The regular lesson which may follow is just as easily established.

Another great advantage, according to teachers, is the vast amount of workable space around all walls.

Disturbances from the outside have always been an annoying factor to the classroom teacher. The control of sound as well as sight has vital significance. Where the indoor climate can be ordered mechanically, and the windows are eliminated or kept closed, the rooms are virtually soundproof and the attentiveness of the children is vastly improved. And with hallway doors closed, you may shut out interior noises. Genuinely useful teaching and learning time is increased by removing interference from the sounds of traffic, mowers and physical education classes.

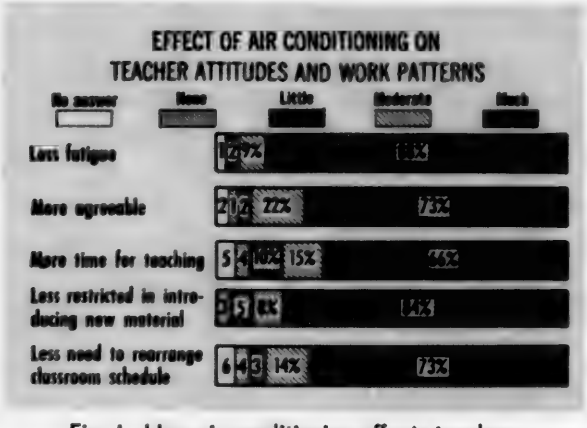


Fig. 1. How air conditioning affects teachers.

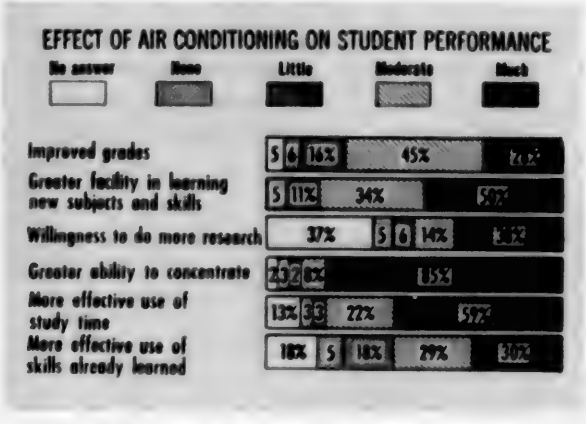


Fig. 2. Influence of air conditioning on students.

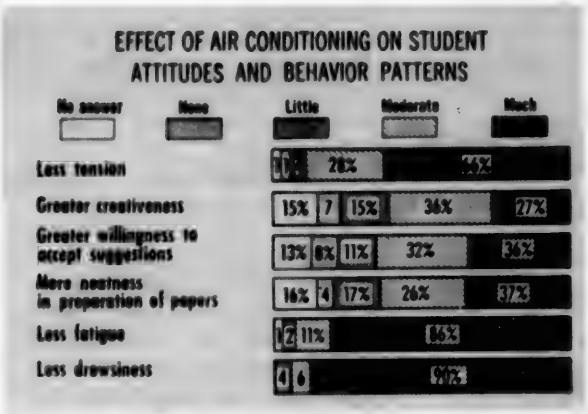


Fig. 3. Effect on student attitudes and behavior.

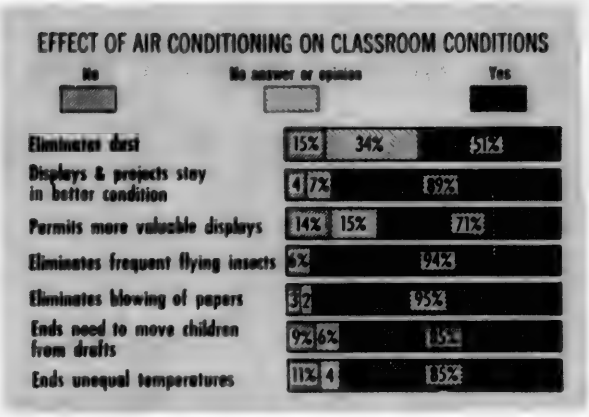

EFFECT OF AIR CONDITIONING ON CLASSROOM CONDITIONS
No
No answer or opinion
Yes
Eliminates dust
Displays & projects stay in better condition
Permits more valuable displays
Eliminates frequent flying insects
Eliminates blowing of papers
Ends need to move children from drafts
Ends unequal temperatures

Fig. 4. Effect on classroom conditions.

Then too, you may have sound-producing activities such as rhythms without disturbing anyone.

Let's turn now to my fourth subject. I believe the need for air conditioning is much greater in schools today than it was a decade ago. Throughout the country more children and adults are wearing sports clothes at home and for many other activities. Consequently, when dressed for school, students find unfavorable temperatures much more noticeable.

My conclusions were confirmed by the responses of other teachers in Alton, San Angelo, Hobbs and Roswell. The questionnaire was filled out by 125 teachers. One of the questions asked was:

"To what extent would you say teacher reactions, attitudes and work patterns are improved or influenced by air conditioning?" (Fig. 1.)

If we are less tired and more agreeable it is obvious that we can do better work. More than 95% of the teachers testify to this reaction.

Time is always an important factor in the classroom. Since we do not have to rearrange the children or adjust the windows, 81% of us feel we would have more time for the class.

When the temperature is high and the children are uncomfortable, especially in elementary grades where the student's attention span is shorter, it is difficult to introduce new material. We usually wait for cooler temperature or try to finish all new material before hot weather starts. But with air conditioning, 92% of the teachers feel they can start a new unit of work at any time.

Where the classroom climate is not controlled, we teach the difficult subjects, or those in which the most drill is needed, in the morning when it is cooler. But this is possible only in elementary schools. In junior or senior high schools, there is a noticeable difference in performance between first and sixth-hour classes in the same subject.

Many teachers are reluctant to state the effect of a good classroom environment on improving the grades achieved by students. The reasons are the difficulty of comparison with those in non-air conditioned buildings and the fact that there is no accurate ruler to measure educational progress.

Yet as shown in Fig. 2, most are convinced that students do better work in an air conditioned room. It is interesting to note the greater belief in air conditioning's effect on learning new subjects as compared to use of skills already learned. Of replies received, 84% say it is of "much" or "moderate" help in the one situation while 59% claim it affects the latter. Many teachers felt the question about willingness to do research didn't apply in their classes because no research was called for, which accounts for the 37% "no answer" vote. The highest score was recorded for greater ability to concentrate, with 93% in the "much" or "moderate" effect columns. More effective use of study time drew 81%. My own experience convinces me that the effect in each case is significant and the student's performance is greatly improved.

Here is what teachers believe comfortable conditions do to student reactions and behavior patterns, Fig. 3. The three highest "much" or "moderate" effect votes were scored for less tension, 94%; less fatigue, 97%; and less drowsiness, 96%. Where arms and papers don't stick to desks, papers are almost certain to be neater. One teacher summed it up in this fashion: "The outside weather does not affect the feelings and emotions of students because they are unaware of it."

I have noticed also that students returning from an air conditioned gym are able to start their academic work immediately without the usual lull of resting and cooling off.

Not only is schoolwork itself improved, but in cities where summer school is taught in air conditioned buildings, the number volunteering has increased substantially. In San Angelo, Mr. George S. Faulkner, assistant principal in charge of summer school, reports that enrollment has more than doubled since moving into an air conditioned building. In Alton, Ill., the enrollment in 1956 was 189, and in 1957 it was 226. In 1958 with an air conditioned building, it jumped to 306, and in 1959 to 367.

These are the major benefits to students and teachers. There are some fringe benefits as well, Fig. 4, although you might not consider them fringe if you had ever seen a room full of students in an uproar over five wasps.

The relatively low 51% vote on dust elimination is a recognition of the fact that most of these schools are new, with sand and dirt near doors and in playgrounds which the children bring in on their shoes. The situation will improve as the grass grows.

ITEMS TO BE CONSIDERED WHEN PLANNING SCHOOLS FOR TOMORROW

PAUL A. MILLER
Superintendent of Schools, Syracuse, N. Y.

What superintendents of schools think of the future of modern school design. Survey shows many prefer buildings without windows, and those adaptable to change in teaching techniques.

AS SUPERINTENDENT of schools in a city with 216,000 population and 30,000 public school pupils, I am naturally concerned with modern school design. How to plan more useful educational buildings, while at the same time cutting costs, are perennial topics for inquiry and discussion among school administrators everywhere.

Recently, I asked my fellow city school superintendents across the country to give me their detailed opinions on the subject of facilities and costs by means of a mail questionnaire. The fact that more than 300 responded during their busy season indicates their deep interest.

What about interior space? Classrooms have been traditionally along outside walls. When they are grouped in a square, many no longer adjoin the wall. How do we handle the ventilating problem? Here is where air conditioning came into our thinking. We soon discovered concepts new to us. We were told that air conditioning was more than cooling or heating. Actually, it is providing tempered air, air consistency, a controlled inside climate, including the right "heatness" or coolness, dryness or wetness, and cleanness. And then how do we create a new kind of daylight? We researched lighting techniques as well.

A questionnaire was sent out. More than half of the superintendents who replied list maximum use of sites among important considerations. Note the importance of reducing maintenance costs, Fig. 1.

There were maintenance savings to be considered in analyzing the costs of our school; diminished heat loss, clean air, clean walls, less redecoration, more suitable classroom interiors. These will be affirmed through experience with the building itself. Another extra comes with the reduction of glass breakage, a sizeable item these days, particularly in cities. Breakage in Syracuse schools will be $15,000 some years. One replaced pane may equal one book.

On the minus side, more mechanical equipment will be needed for tempered air. Greater maintenance is required as compared with conventional heating and ventilating. But the heating bill itself in cold Syracuse will be less.

Let's ask this question:

Will the 12-month school year be more common during the lifetime of this building? Dr. James E. Allen, Jr., New York State Commissioner of Education, expressed himself recently in the press as favorable to the longer school year and longer school day.

How can you get along without windows? Let's analyze this by posing some other questions. What are they used for now? Ventilation? No. Actually they are the source of heat build-up. Light? Unsatisfactorily. Shades are pulled now. Modern lighting is better without windows. Vision? What can you see in a city—especially with the shades pulled? In the country? What about the glare? Windows are about as obsolete as the whip socket on the first gas buggies. So out goes the window.

Can the interior classroom be better adapted to modern instructional aids? Pictures can be used more effectively, efficiently, and often through films and Educational TV.

What do other superintendents think about the future of such modern school design? I have mentioned that more than 300 city school superintendents have given me the benefit of their thinking. I generally agree with those who believe:

1. That future design will differ significantly from the present.
2. That a core or laboratory approach to learning will determine future educational specifications.
3. That Educational TV will greatly influence design thinking.
4. That environment plays an important part in the learning process.
5. That spring, summer, and early fall are critical months due to heat and light intensities.
6. That air conditioning will provide a much better instruction-learning environment.
7. That site acquisition, maintenance, flexibility, and building usage are important to planning.
8. That the public at large has little opinion about air conditioning because it has not been informed.
9. That teachers favor an air conditioned environment.

Almost half of the superintendents believe design will differ significantly during the next few years from that of the past. I asked them whether certain areas of wide current interest to educators would affect design. A summation of their answers is shown in Fig. 2.

Six out of 10 believe Educational TV, known to schoolmen as ETV, will be a factor. Only 26% consider the 12-month school year a possibility.

In the area of curricula which might affect design, 53% believe the subject-oriented will continue to control planning; 26% expect the core plan to have an influence.

Still in the area of design, I asked the superintendents about windows. More than a fifth want to eliminate them, but nearly half want to retain them and the remainder are undecided.

Problems of most concern to them, Fig. 3, were, in order, increased construction costs 83%, high land cost 49%, and the need to keep certain areas of buildings adaptable to various uses 47%. All three of these relate to questions of design which I have discussed.

In speaking of construction, superintendents use the words flexibility and adaptability quite often.

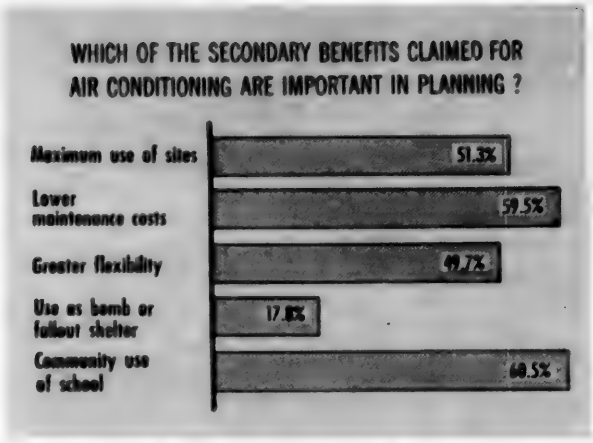


Fig. 1. Secondary benefits of air conditioning.

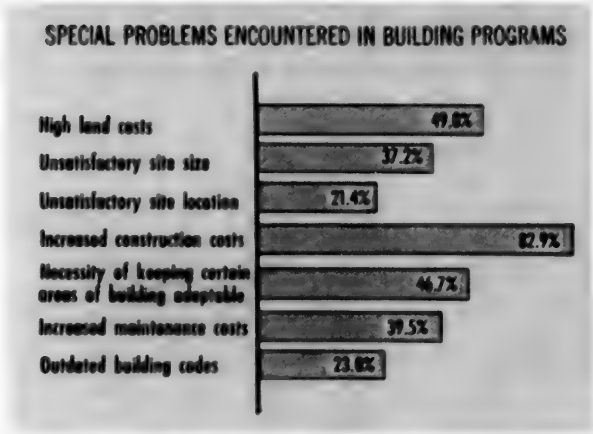


Fig. 3. Problems in building programs.

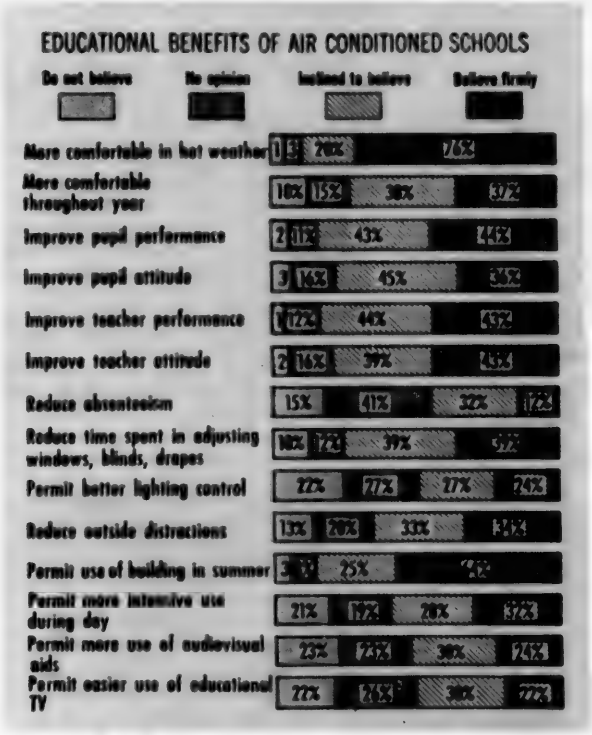

EDUCATIONAL BENEFITS OF AIR CONDITIONED SCHOOLS
Do not believe
No opinion
Inclined to believe
Believe firmly
More comfortable in hot weather
More comfortable throughout year
Improve pupil performance
Improve pupil attitude
Improve teacher performance
Improve teacher attitude
Reduce absenteeism
Reduce time spent in adjusting windows, blinds, drapes
Permit better lighting control
Reduce outside distractions
Permit use of building in summer
Permit more intensive use during day
Permit more use of audiovisual aids
Permit easier use of educational TV

Fig. 5. Benefits of air conditioned schools.

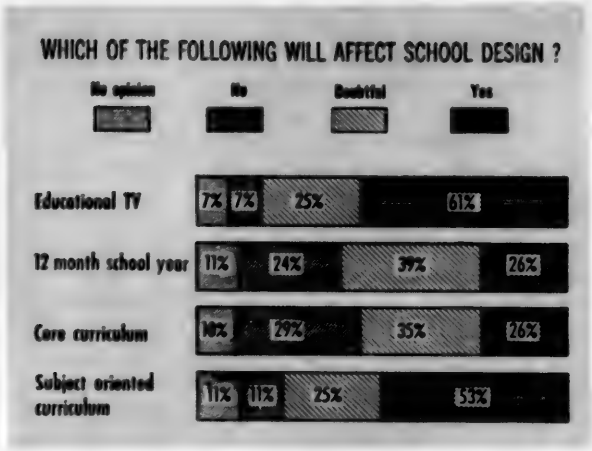


Fig. 2. Influence on school design.

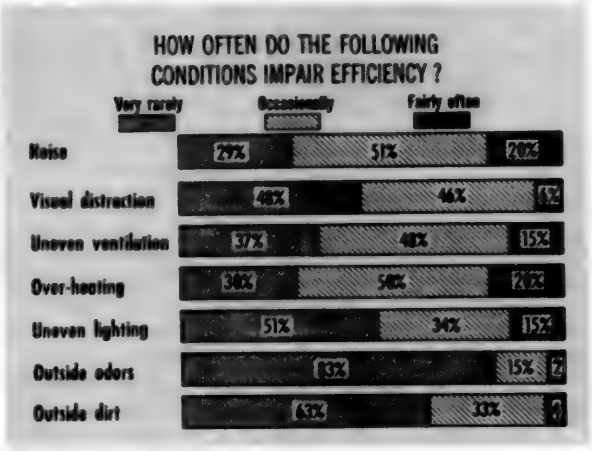


Fig. 4. Effect of specific conditions on efficiency.

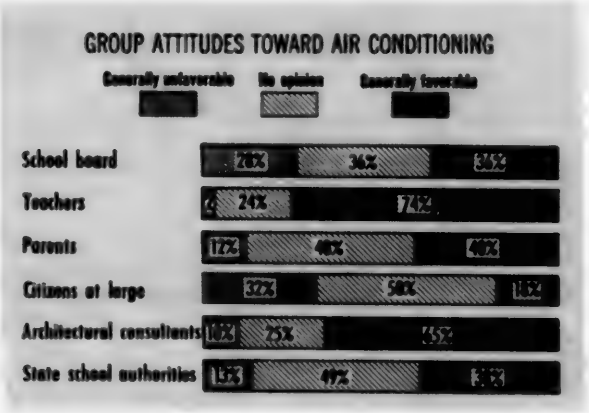


Fig. 6. Attitudes of special groups.

Here, in graphical form, are the results of a survey conducted by Dr. Paul A. Miller. School superintendents all over the country were asked to answer a mail questionnaire. The answers were calculated on a percentage basis and a set of charts was prepared.

They mean school units must be capable of change and retooling to allow new teaching techniques and new technical aids now in sight.

Among the 300 responding districts are 47 elementary schools and 33 high schools which have air conditioned classrooms. Against total construction plans calling for 1,050 schools, 44 air conditioned ones are definitely planned, and 89 are under consideration.

Only one in five administrators has really investigated the relative cost of building a school with air conditioning as a design factor; another 11% are looking into the matter; 59% of my colleagues think schools designed around air conditioning cost more.

What about the educational benefits of a controlled environment? Most of the superintendents believe that physical distractions in their present classrooms impair teaching and learning efficiency, occasionally to fairly often, Fig. 4. Most significant they say are noise 71%, visual distraction 52%, uneven ventilation 63%, overheating 70%, and uneven lighting 49%.

Seventy-five per cent of my colleagues have summer sessions now. More than 60% believe the physical environment impairs the effectiveness of these sessions. Late spring, early fall and summer are picked as the times of year when the physical environment is most unfavorable, although 7% also name winter. A great majority of superintendents are of the opinion that air conditioning will result in some benefit to the educational program, particularly during hot weather.

Look at their attitudes, Fig. 5. Adding together the "believe firmly" and "inclined to believe" responses, we see that 87% say it will improve pupil performance and 81% that it will improve their attitudes. Better teacher performance and attitudes draw 87 and 82% of the votes; 51% believe there can be better control of lighting, 67% that outside distractions will be reduced, and 54 and 52% respectively say that more use of audio-visual teaching aids and Educational TV will be permitted.

Superintendents generally indicate that a greater public understanding of air conditioning is needed. Here is what they say, Fig. 6.

A substantial majority report teachers and architectural consultants favorable to air conditioning; 36% feel that board members are favorable; 40% say the same of parents. A third say the citizens in their districts would be unfavorable. Many of all groups are found in the "hold no opinion" column.

Fig. 1. Frontier one room school.

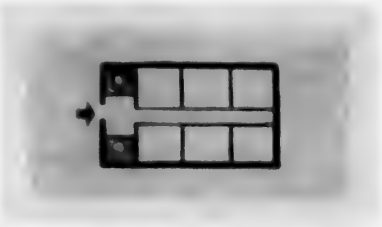


Fig. 2. Expanded school.

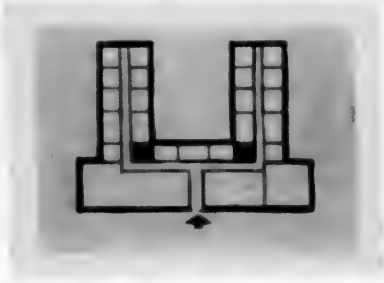


Fig. 3. School with added rooms.

ENVIRONMENT FOR LEARNING

WALTER T. ROLFE
Partner of Golemon and Wolfe, Architects and Engineers, Beaumont, Texas

Changes that have taken place in school architecture. School design, development as a special research project, offers many advantages to a changing school curriculum.

THIS is a time of great change in educational planning. A highly conservative institution, the public schools, has faced a serious challenge to graduate youngsters better equipped than ever before, and to do so within the restrictions imposed by economic reality.

In early American education the frontier school was a one-room, one-teacher, several-grades, minimum-subjects unit, Fig. 1. Illumination was mostly by sun. The width of the room was determined by the span that available construction materials made practical. Heating was by the simple round stove and ventilation was difficult. Little or no plumbing was included.

Where there were greater concentrations of people and a need to house more students, the school plan expanded with more rooms and more teachers but with the same concept of each teacher handling all subjects for her roomful of pupils. See Fig. 2.

With the need for larger centers, the plan grew more complex. The double-loaded corridor had become common. With it remained the problems of ventilation, lighting and sound control, Fig. 3.

Ultimately, the large rather compact public school evolved, particularly in the cold areas. Its compactness resulted from restrictions of land availability and the difficulty of heating in extreme weather. Central heating was used. See Fig. 4 for a general floor plan.

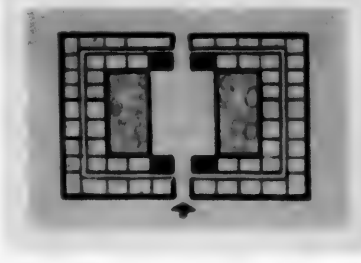


Fig. 4. Compact school design.

The warmer parts of the country encouraged the development of the finger plan with cross-ventilation through the classrooms. For economy, the single-loaded open corridor came into use. North or south room orientation and resulting sun protection were more serious. A west-facing classroom was almost impossible to live in during the afternoon. Sunlight, glare and prevailing winds were constant factors affecting design. This plan, Fig. 5, however became popular in many areas of the country without regard for climatic appropriateness or orientation.

The finger plan readily led to other variations of the idea that indoors and outdoors should be united as a teaching environment. Many very interesting schools of this kind have been done. The campus plan, Fig. 6, ultimately resulted. It likewise has been a popular plan since it appeals to the basic needs for an approach to a school design where flexibility can be had.

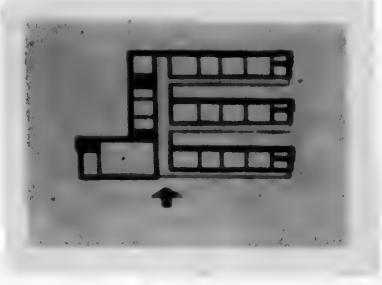


Fig. 5. Finger plan school.

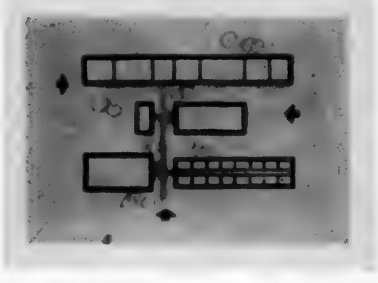


Fig. 6. Campus plan school.

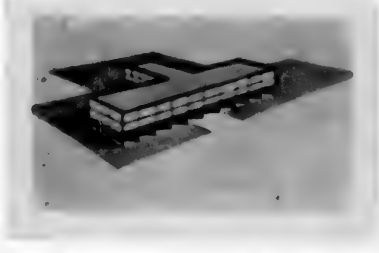


Fig. 7. Added space for classes.

Not only were plans opened horizontally, but vertically as well. Additional floor space above open first-floor play areas became available. See Fig. 7.

It was only a matter of time until the larger school plan would point toward the scattered unit plan, Fig. 8. This seemed to be the ultimate in the open plan with its attending problems of control, cost and circulation.

There are many schools throughout the country that indicate newer trends in design.

One of the earliest to be erected was Bellaire Elementary School in San Angelo, Tex., Fig. 9. This school was to be built within hearing distance of an airport. Control of the thermal environment offered an opportunity among other advantages to minimize the distraction of external sounds. While the walls are of glass, they are not opened.

The building is circular, and I should note here that a circle requires the least amount of perimeter in relation to enclosed space of any geometrical shape. The classrooms are roughly pie-shaped ending in a central auditorium. The partitions are movable as are many items of furniture. One or more classrooms can be opened to become part of the auditorium area.

Here is St. Pius X high school in Atlanta, Ga., Fig. 10. The plan consists of a large square section with other elements attached to it. It has limited windows in a perimeter zone of classrooms. It has a large interior classroom area and is climatically controlled. It is another interesting approach to a better school environment through compactness. It also indicates the difference in facilities needed in a secondary school as compared with an elementary building.

The development of F. Ware Clary Junior High School in Syracuse, Fig. 11, has already been reported. It is presented here only to give you a comparison with some of the other new developments. It is composed basically of two connected, nearly square plan sections. Perimeter corridors and limited windows reduce radiation.

The Abilene Junior-Senior High School, Abilene, Tex., takes a somewhat different direction, Fig. 12. It is a semi-campus plan and is completely air conditioned. It limits windows to a minimum and orients them to inset entryways to reduce visual distraction. It allows freedom of use of space in the teaching unit while providing a year-round climate enjoyed by pupils in much the same way as in their homes and their family cars. Another cost-cutting factor is reduction of ceiling heights to 8.6 ft from the more traditional 9 ft and higher. The unit cost is reported at $11.65 a sq ft which compares favorably with the unit costs of other schools in the district.

One of the interesting and well-accepted compact designs is that of Roswell, N. M., Fig. 13. It represents the results of a period of research in consultation with the Hobbs, N. M., superintendent and school board. Included were interviews with most of the teachers to

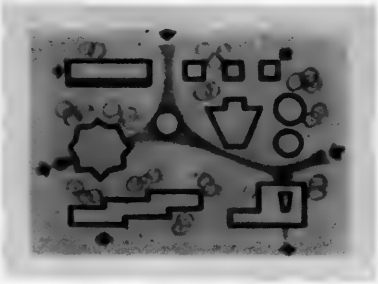


Fig. 8. Scattered unit plan.

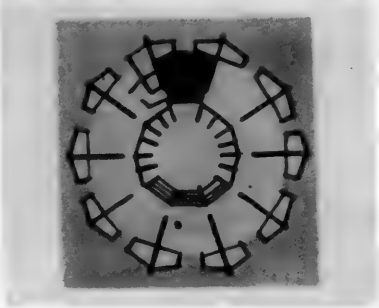


Fig. 9. School in Texas.

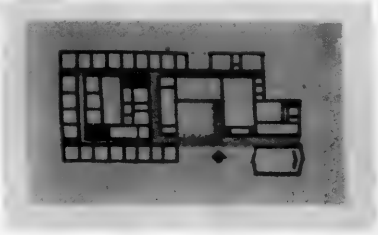


Fig. 10. Atlanta, Ga., high school.

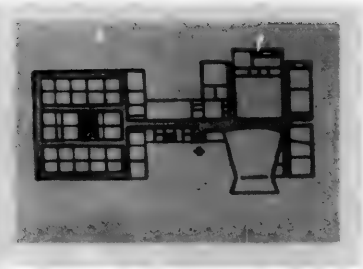


Fig. 11. High school in Syracuse.

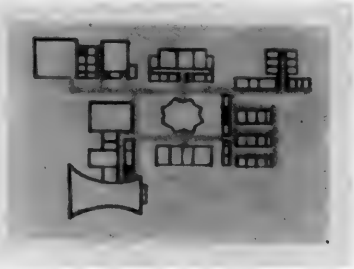


Fig. 12. School in Abilene, Tex.

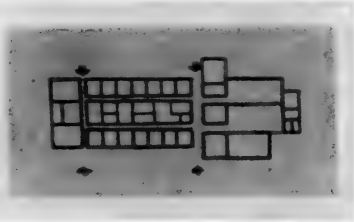


Fig. 13. School in Roswell, N. M.

find out what they considered ideal conditions. When it appeared likely that reducing glass area would be one of the answers, the Board of Education eliminated many of the windows in a headquarters building it was then planning to determine the reaction of the administrative group. In addition to providing a better educational environment, the architect was concerned with reducing building and operating costs, glare and infiltration of dust with its effect on maintenance.

In the present study, we were commissioned and given a completely free hand to develop a secondary school building providing some new answers. It has been most helpful in showing a practical way to bring the research capacity of practicing architects and engineers to industry and the public. A real challenge was present from the beginning. All of the many who were associated with the project felt the vitality of looking for a fresh approach to school design based on current and future teaching concepts and attempting to achieve a superior environment for education at less cost—both initial and ultimate.

In the evolving pattern of school architecture, it had become obvious that a change of direction and emphasis might be indicated. What would happen if the plan were completely closed and reduced to its simplest geometry, permitting schools to take advantage of the completely controlled environment now commonly accepted in the business and industrial world?

After several months of interviews with teachers, administrators, and pupils, preliminary studies were begun. These studies were then shown to teachers, administrators, curriculum specialists, The Texas Education Agency staff, other architects and engineers. The response was very favorable and it encouraged all of us to complete the study which briefly follows.

This research study is called Environment for Learning, known as *EFL*, with first emphasis on the learning process.

In order that the research project would offer a valid comparison relative to program and costs, a comparative school, recently built, was chosen. Bellaire High School, a school for 2,000 pupils, was selected because data on its cost were recent, accurate and complete. It was designed by our firm in 1954 for the Houston Independent School District in Bellaire, Tex. It is considered a typical senior high school in Houston and was an award-winning design.

The programs for the two schools are virtually the same. Both provide facilities for administration and services, a library, an auditorium for 1,200, rooms for 60 classes, a student center, music and dramatics, counseling and guidance, physical education, vocational education, teachers' areas, and building services.

The *EFL* plan groups all perimeter activities around the central basic teaching core, which permits the use of a long-span, loft type of building allowing maximum freedom for the present—and the future.

No longer is the teaching unit controlled by materials, construction limits, ventilation or other inherited factors that have so long been with us. Recent engineering advances in indoor climate and illumination control now bring this new freedom within reach of the new schools of our nation.

Glass walls move from outdoors to indoors where with lowered maintenance they open new vistas. Architecturally the school turns its attention to learning procedures where the human intellect of whatever ability or age can bear directly on its own advancement under highly favorable conditions day or night, the year around.

Many complex engineering problems are solved outright with the *EFL* concept. The difficulty of balancing daylight and engineered illumination is gone. In a completely controlled environment the quality and quantity of illumination can be varied for the task at hand. Glare can be eliminated. Orienting the student with respect to outside illumination is no longer necessary.

The air conditioning system is not affected by variations in the sun load through windows in different rooms. Therefore its control system is very simple and inexpensive. A high-velocity, dual-duct, all-air system centralizes mechanical equipment in one location, assures positive ventilation, efficient air cleaning, much better control of temperature, humidity and noise. A recently developed air purifier affords odor removal, humidity control, and automatic filter cleaning. The peak refrigeration load is 400 tons or about half the tonnage required for a conventional school of the same area in Houston. The heating demand requires a surprisingly small amount of supply, practically none for Houston. The heat from lights and human beings is more than enough to handle building needs even when the temperature is 20 deg F outside.

Toilet locations shorten plumbing runs. Electric runs are more economical. External noise is eliminated and interior sound can be largely controlled because doors and moving walls can be kept closed without temperature discomfort. The structural system is simple, direct, and economical. Both schools are fireproof, *EFL* having a steel frame and Bellaire having frames of steel in part and concrete in the three-story section.

FLOW OF WATER IN CIRCULAR SEWERS

Concluded from July. Table by J. Nachbar, associate, Albert Kahn Associated Architects and Engineers, Detroit, Mich.

Pipe ID, Inches	Slope of the Hydraulic Grade Line, Ft per Ft								Pipe ID, Inches
	.050		.055		.060		.065		
	V = Mean Flow Velocity, Ft per Sec, Q = Flow Capacity, Cu Ft per Sec								
	V	Q	V	Q	V	Q	V	Q	
4	4.1	.35	4.3	.37	4.4	.39	4.6	.40	4
5	4.9	.67	5.1	.70	5.3	.73	5.6	.76	5
6	5.6	1.11	5.9	1.16	6.2	1.22	6.4	1.27	6
8	7.1	2.5	7.4	2.6	7.8	2.7	8.1	2.8	8
10	8.4	4.6	8.9	4.8	9.2	5.0	9.6	5.2	10
12	9.7	7.6	10.2	8.0	10.6	8.4	11.1	8.7	12
15	11.5	14.1	12.0	14.8	12.6	15.4	13.1	16.1	15
18	13.1	23.2	13.8	24.4	14.4	25.4	15.0	26.5	18
21	14.7	35.4	15.4	37.1	16.1	38.8	16.8	40.3	21
24	16.2	51	17.0	53	17.7	56	18.5	58	24
27	17.6	70	18.5	73	19.3	77	20.1	80	27
30	19.0	93	19.9	98	20.8	103	—	—	30

Pipe ID	Slope of the Hydraulic Grade Line, Ft per Ft								Pipe ID
	.070		.075		.080		.085		
	V	Q	V	Q	V	Q	V	Q	
4	4.8	.42	5.0	.43	5.1	.45	5.3	.46	4
5	5.8	.79	6.0	.81	6.2	.84	6.4	.87	5
6	6.7	1.31	6.9	1.4	7.1	1.40	7.4	1.4	6
8	8.4	2.9	8.7	3.0	9.0	3.1	9.3	3.2	8
10	10.0	5.4	10.3	5.6	10.7	5.8	11.0	6.0	10
12	11.5	9.0	11.9	9.3	12.3	9.6	12.7	9.9	12
15	13.6	16.7	14.1	17.3	14.5	17.8	15.0	18.4	15
18	15.6	27.5	16.1	28.5	16.6	29.4	17.1	30.3	18
21	17.4	41.9	18.0	43.3	18.6	44.8	19.2	46.1	21
24	19.2	60	19.8	62	20.5	64	—	—	24
27	20.8	83	—	—	—	—	—	—	27

Pipe ID	Slope of the Hydraulic Grade Line, Ft per Ft						Pipe ID
	.090		.095		.100		
	V	Q	V	Q	V	Q	
4	5.4	.48	5.6	.49	5.7	.50	4
5	6.5	.89	6.7	.92	6.9	.94	5
6	7.6	1.49	7.8	1.53	8.0	1.57	6
8	9.5	3.3	9.8	3.4	10.0	3.5	8
10	11.3	6.2	11.6	6.3	11.9	6.5	10
12	13.0	10.2	13.4	10.5	13.7	10.8	12
15	15.4	18.9	15.8	19.4	16.2	19.9	15
18	17.6	31.2	18.1	32.0	18.6	32.9	18
21	19.7	47.5	20.3	48.8	20.8	50	21

The table which is concluded this month was developed especially for use in design of drainage systems for large and small industrial plants. It is, however, within the ranges selected, applicable to any sewer sizing problem. Included were slopes from 0.001 to 0.100 ft per ft.

WHEEL LOAD TRANSMITTED TO PIPE UNDER A ROAD

Pipe laid under roadways must be able to withstand the crushing load imposed by vehicles passing over it. The following procedure for calculating that load is suggested by Johns-Manville Sales Corp., New York, N. Y.

The total maximum load per foot of pipe is composed of a fraction of the weight of earth in the trench above the pipe and of the live load imposed by vehicles. Both partial loads depend upon the width and depth of backfill over the pipe.

The earth load is computed from the Marston-Anderson formula,

$$W = CwB^2$$

where W = load on conduit per ft, lb,

$C = (1 - e^{-2kH/B})/2k$ (dimensionless)

w = density of fill, lb per cu ft,

B = width of trench, ft,

H = height of fill over conduit, ft, and

k = constant from Table 1.

Live load depends upon the weight of the vehicle passing over and the weight distribution among its wheels. For design purposes the weight of the heaviest, loaded vehicle that will pass over the pipe should be ascertained. Distribution of weight among the axles needs to be known, since only one axle can pass over the pipe at a given instant. In the case of trucks, it can be assumed that the rear axle or axles will take 80% of the load. Since only the loading per foot of pipe is sought, the rear-axle load can be halved, as only one wheel at a time will contribute to the load. Table 2 lists the percentage of wheel load that is transmitted to the buried pipe.

It should be noted that Table 2 applies only to pipe buried under dirt roads or roads with soft surfaces. The surface of a concrete highway will absorb all but a negligible portion of the live load.

It should also be noted that proper bedding precautions must be taken so that the weight exerted on top of the pipe becomes a crushing load, rather than a flexual load.

Example:

What must be the minimum crushing strength of pipe laid under a soft-surfaced road if the trench is 3 ft wide and there is 3 ft saturated clay cover, given that the heaviest vehicle on the road will weigh 65,000 lb and have two rear axles?

From Table 1, find k and w for saturated clay. Substitution in the Marston-Anderson formula yields an earth load of approximately 1100 lb.

If 80% of 65,000 lb is transmitted to the rear axles of the truck, then 52,000 lb is distributed on the four wheels of the two rear axles, or 13,000 lb per wheel. Entering Table 2 at a depth of backfill of 3 ft and a trench width of 3 ft, it is seen that 11.3% of the wheel load is transmitted, or 1469 lb.

The sum of the dead and live loads, 1100 + 1469 = 2569 lb per foot of pipe.

Table 1. Characteristics of Fills

Fill Type	Density, w	Factor, k
Gravel	100	0.1924
Sand and gravel	110	0.165
Saturated sand	120	0.165
Clay	120	0.130
Saturated clay	130	0.110

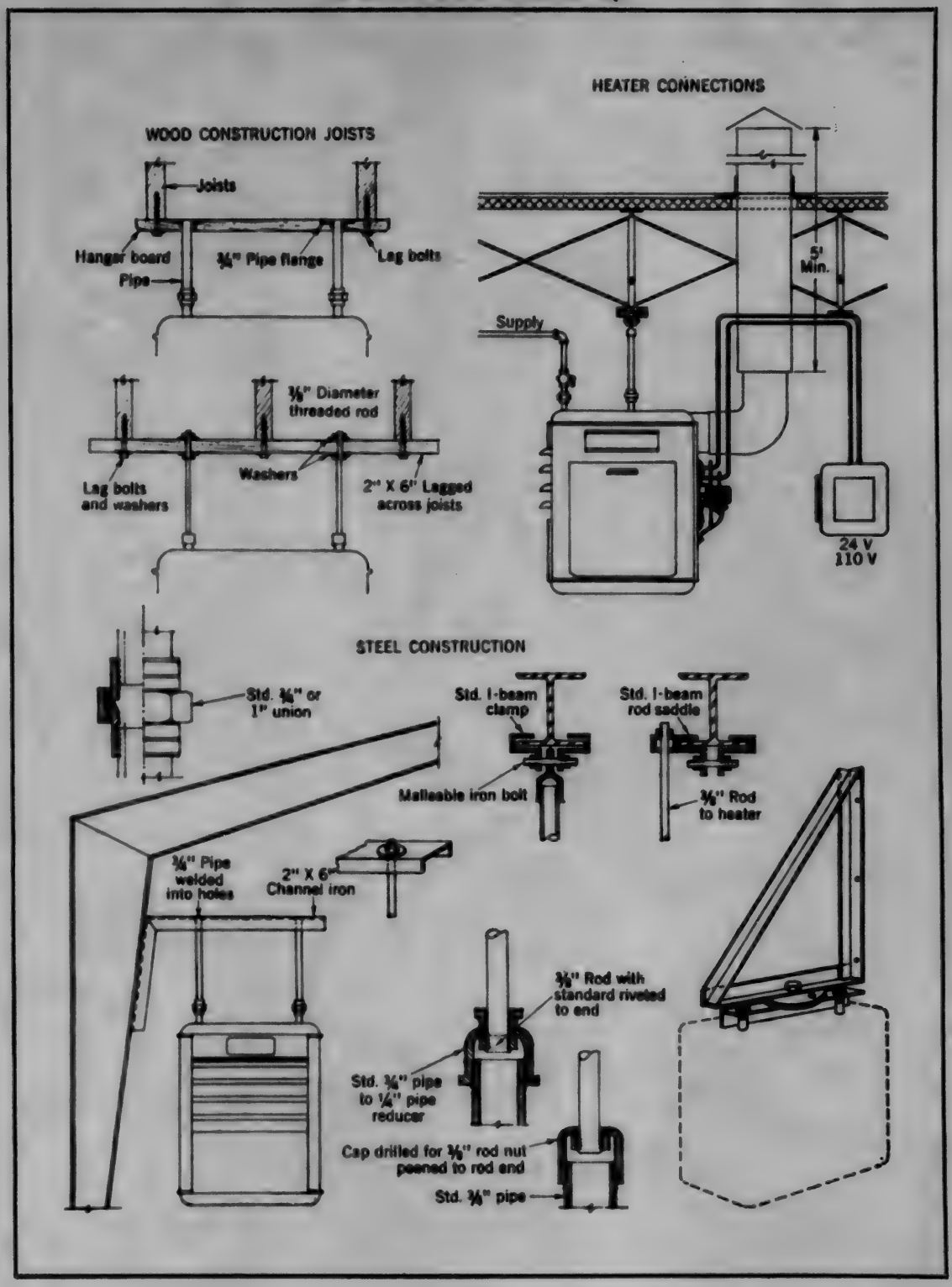
Table 2. Percentage of Wheel Load Transmitted to Underground Pipes

Depth of Backfill over Top of Pipe, Feet	Trench Width at Top of Pipe, Feet						
	1	2	3	4	5	6	7
	Percentage of Wheel Load Applied to One Lineal Foot of Buried Pipe						
1	17.0	26.0	28.6	29.7	29.9	30.2	30.3
2	8.3	14.2	18.3	20.7	21.8	22.7	23.0
3	4.3	8.3	11.3	13.5	14.8	15.8	16.7
4	2.5	5.2	7.2	9.0	10.3	11.5	12.3
5	1.7	3.3	5.0	6.3	7.3	8.3	9.0
6	1.0	2.3	3.7	4.7	5.5	6.2	7.0

Note: *Live loads transmited are practically negligible below 6 ft.*

GAS-FIRED UNIT HEATERS

Details of Installation and Hookup

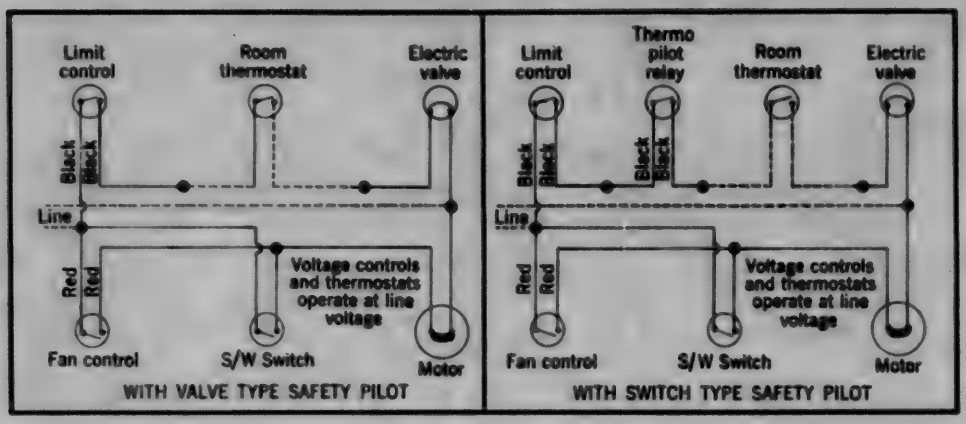


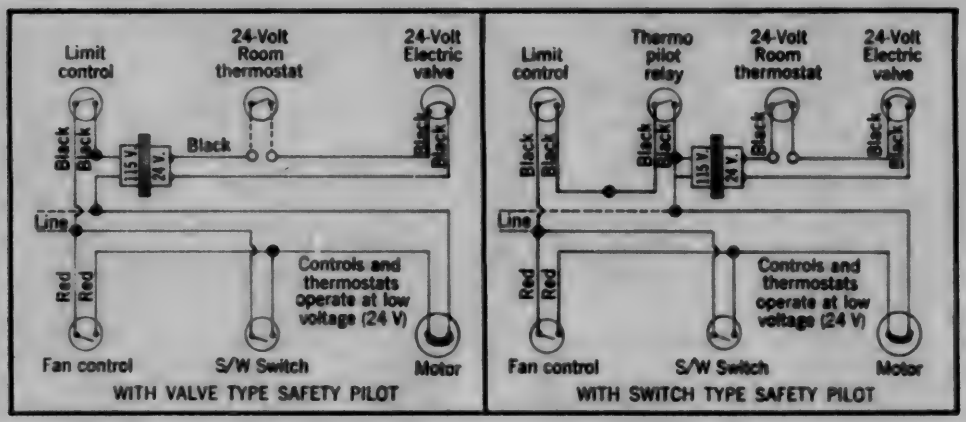
DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

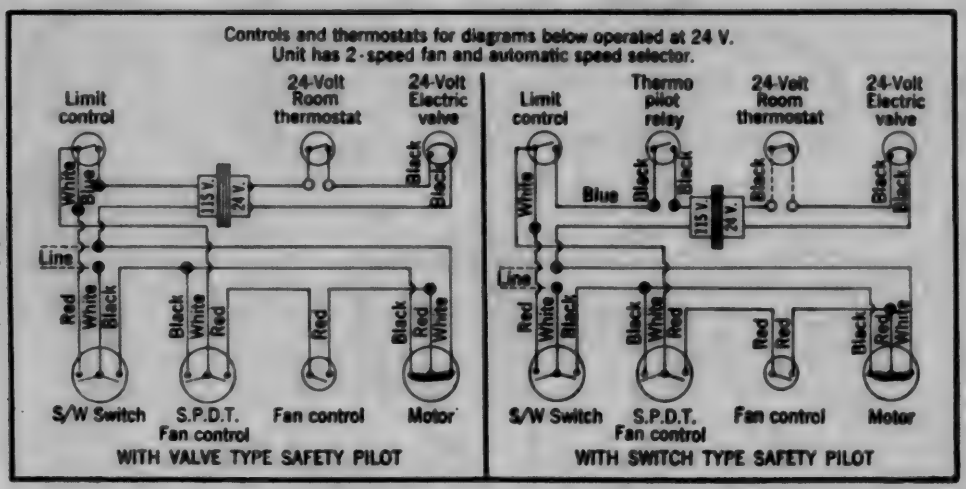
August, 1960

GAS-FIRED UNIT HEATERS

Wiring Diagrams for Control of Unit







Drawings on This and Reverse Side, Courtesy of Reznor Manufacturing Co., Mercer, Pa.

CENTRIFUGAL FAN APPLICATION GUIDE: Part 5—

How Much Air Is Delivered?

C. J. TRICKLER
Chief Engineer, The New York Blower Company, Chicago, Ill.

Part 5, the concluding installment in this series, details the steps involved in field testing a fan. Appended is a Field Test Sheet with provision for recording all the data and performing all the necessary calculations when testing in the field.

THE FREQUENTLY ASKED QUESTION, "How much air is the fan delivering?", indicates how important a knowledge of fan testing is to the ventilation system designer and installer. The question arises when a ventilation system is not functioning properly, or it needs balancing, or when a system is to be changed and actual, rather than estimated values, are needed.

Field testing a fan is not difficult, nor are the instruments expensive. As in most engineering work, though, there are a few pitfalls to be avoided.

Fan performance can be measured in a laboratory with good accuracy, but few installations allow the use of laboratory methods. Fortunately, field tests rarely require laboratory accuracy. Air volume measurements to within 5% of actual value are almost always accurate enough, and ±10% is usually sufficient.

The test methods herein described are designed to give as complete as possible a check on fan performance. They include determinations of air volume (CFM), fan pressure (SP) and brake horsepower (BHP). When field tests are concerned only with air volume measurements, some of the steps may be omitted.

What Instruments Are Needed? Which Are Best?

1. By far, the best method of measuring either air velocity or static pressure is with the pitot tube and manometer. Lack of moving parts and fundamental simplicity make this set of instruments inexpensive, accurate, and nearly foolproof. It may be used in any atmosphere and needs no adjustment. Figure 1 shows a pitot tube cross section, and Fig. 2 shows how it indicates pressures.

Fig. 3. Manometer and pitot tube kit. Photo courtesy of F. W. Dwyer Manufacturing Company.

These should be the first instruments in any fan test kit. Manometers such as shown in Fig. 3 may have velocity graduations marked directly in feet per minute for use where barometric pressure and temperature corrections may be ignored. These make the pitot tube one of the easiest to use of all air flow measuring instruments.

2. There are cases where a pitot tube may not be used for air volume measurements since it requires a long straight run of duct. Several instruments have been marketed for air measurement through grilles, hoods, filter banks, and even fan inlets. None of them are as accurate as a pitot tube, and all are subject to mechanical failure and wear.

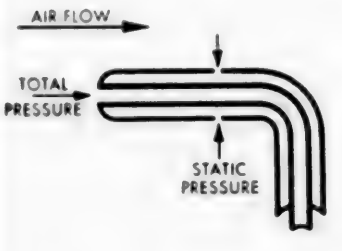


Fig. 1. Pitot tube cross section.

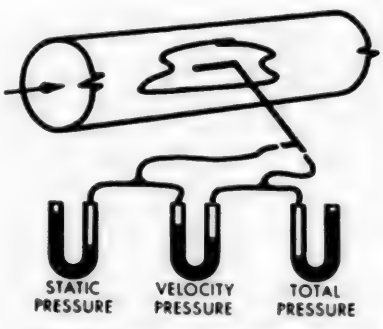


Fig. 2. Pitot tube in outlet duct.

The *velometer* shown in Fig. 4 can be fitted with attachments to cover various velocity ranges and applications. It is more expensive than the anemometer shown in Fig. 5, but less subject to misapplication.

The *anemometer* is relatively accurate when measuring a constant volume of air that flows straight through it at a uniform velocity perpendicular to its face. It can be quite misleading, though, if used in non-uniform velocities, as those discharging from a grille or where air approaches from an angle.

Several manufacturers offer models of *thermo-anemometers*. These use the principle that electrical resistance of a wire varies with the cooling effect of air flowing over it. While accurate for very low velocity laboratory work, they are subject to so many variables that their use should be avoided in field work.

3. A clip-on *ammeter-voltmeter* will usually allow fairly accurate estimates of fan motor horsepower.

4. Fan RPM can be determined with a revolution counter and watch, or with a more expensive *tachometer*.

5. An accurate *thermometer* is the last field test instrument needed. It should cover whatever temperature range is anticipated.

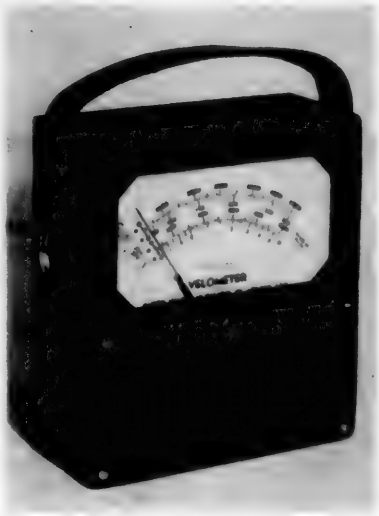


Fig. 4. Velometer. Photo courtesy of Illinois Testing Laboratories, Inc.

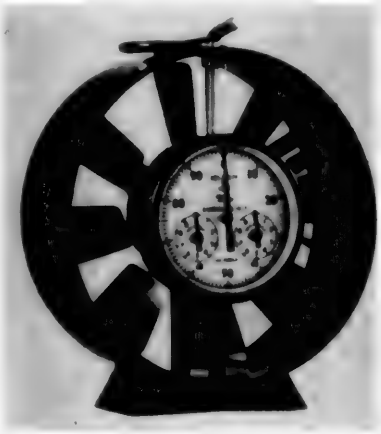


Fig. 5. Anemometer. Photo courtesy of Taylor Instrument Co.

How To Make The Test

1. Make a sketch of the system for your records and as a guide for selecting points for readings. Very often this will bring to notice poor design features.

2. The installation should be examined with an eye to certain construction features. Laboratory test installations are designed to give smooth air flow to and from the fan. See Fig. 6. Inlet ducts are of the same area as the fan inlets and 10 diameters long. Outlet ducts have the same area as the fan outlets and are also straight for a distance of 10 dia. Both ducts have straighteners before the point of reading. This set-up avoids turbulence and spinning flow in the ducts and entering the fan. Such installations are seldom found in actual practice and the greater the deviation, the greater the error to be expected. Above all, fans with any but a straight inlet connection should be carefully examined. No single factor can destroy a fan's efficiency more subtly than a poor inlet connection. These are the reasons fan manufacturers state that their ratings are guaranteed with respect to laboratory tests, not to field installations.

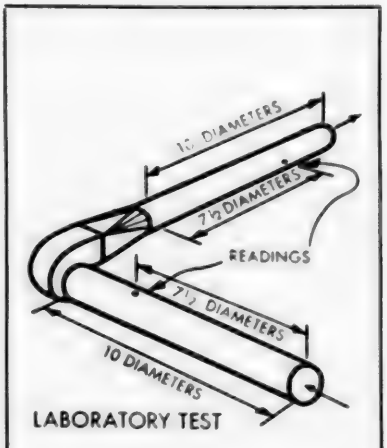


Fig. 6. Test installation designed for smooth air flow.

3. Decide what instruments to use and where to take the pressure and air volume readings. If there is a long run of straight duct near the fan through which all of the air flows, then the air volume measurements should be made with pitot tube. If there are no straight runs of duct, the air volume must be determined at the system entrance or exit with a velometer or anemometer, or it can be determined indirectly by comparing the fan pressure and horsepower readings with the fan performance tables or curves.

In a laboratory, test pressure readings are taken at well defined points, but actual installations usually make these points awkward If a straight length of duct several diameters long can be found, the readings should be taken toward the downstream end. (The end nearest fan on inlet side and farthest from fan on outlet side.)

Figure 7 shows what might be three varieties of field conditions and the best points for these test readings.

4. If best accuracy is desired, and the air volume test is made with a pitot tube, these steps should be followed:

(a) Record velocity *pressures*, not velocities, at the pitot probe points. Twenty points are taken in a round duct, sixteen in a rectangular duct. Location of these test points is shown on the Field Test Sheet at the end of this article.

(b) Take the square roots of the individual velocity pressures and compute their average value.

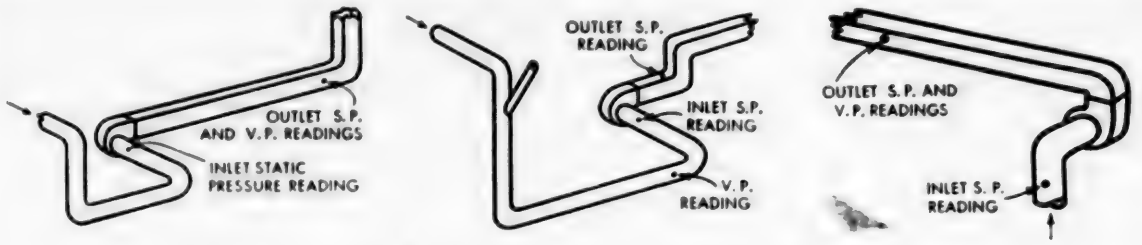


Fig. 7. Three possible field conditions and the best points for test readings.

(c) Determine the density of the air flow through the fan during the test by recording the dry-bulb temperature in the fan and the barometric pressure. Find density (in pounds per cubic foot) by this formula:

$$0.075\left(\frac{530}{460 + {}^{\circ}\text{F}}\right)\left(\frac{Bar.\ Pressure}{29.92}\right)$$

Barometric pressure may be obtained from the nearest weather station. (Be sure the barometric pressure is correct for your altitude and that it is not corrected to sea level reference.)

(d) Determine the ratio of standard density air (0.075 lb per cu ft.) to test density, and call the ratio K.

$$K = \frac{0.075}{\text{Test Density}}$$

(e) Average air velocity in test duct = 4000 times the square root of K times average VP from step (b). Average velocity is based on the average square root of the velocity pressure and not on the average velocity pressure because velocity is proportional to the square root of the velocity pressure.

5. Inlet and outlet static pressure readings must be corrected for density by multiplying them by the same K density factor used for velocity pressures.

6. Fan motor horsepower many be determined in any of several ways. The best is to read the volts and amperes going into the motor and apply the formula: HP equals the square root of three times the product of volts, amps, power factor, and motor efficiency, all divided by 746, which applies to a 3-phase motor. However, this necessitates obtaining the power factor and motor efficiency from the motor manufacturer, which may often be awkward.

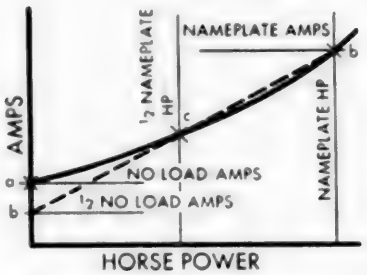


Fig. 8. Amperes vs. horsepower.

Another method is to draw an *amps vs. horsepower* curve, as shown in Fig. 8. This is done by plotting a rough *horsepower vs. amps* curve for the motor, as per the procedure that follows:

(a) Establish no-load amps by running disconnected from fan (point *a*).

(b) Draw dotted line through one-half no-load amps, at zero HP, and nameplate amps, at nameplate HP. (points *bb*).

(c) At one-half nameplate HP, mark a point on this line. (point *c*).

(d) Draw a smooth, solid curve through these three points (*a*, *c*, *b*).

(e) Determine running HP by plotting running amps.

Fan horsepower, like velocity pressure and static pressure, must be multiplied by the K density correction factor.

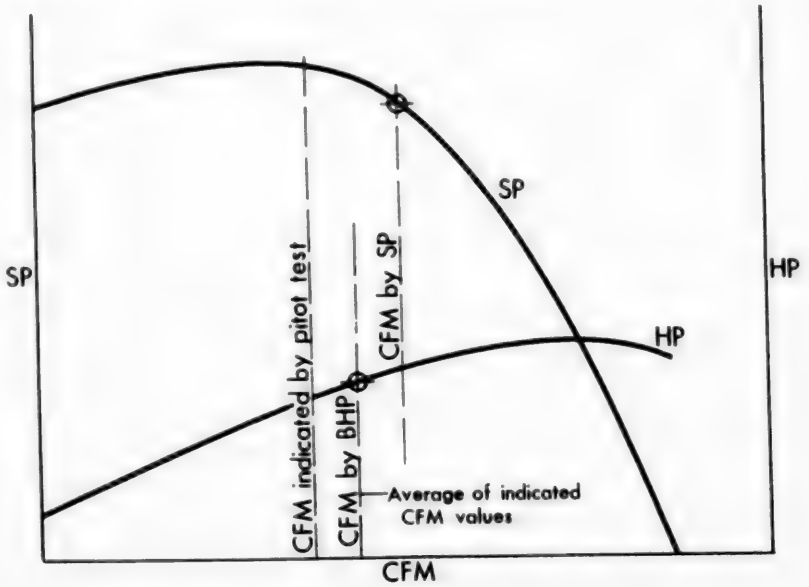


Fig. 9. Typical fan curve and field test points.

FIELD TEST SHEET

FAN OWNER _____

_____

FAN MFR. _____

FAN NAMEPLATE DATA _____

DATE _____ BY _____

FAN RPM _____ APPROX. BHP _____

MOTOR NAMEPLATE DATA _____

READINGS	S P (outlet)	S P (inlet)	V P	$\sqrt{V P}$
1 2 3 4 5				
6 7 8 9 10				
11 12 13 14 15				
16 17 18 19 20				
TOTAL			XXXXXXX	
AVERAGE				

Density = $.075 \left(\frac{530}{460+^{\circ}F}\right) \left(\frac{\text{Barometric Pres.}}{29.92}\right)$

= _____ lbs. per cu. ft.

"k" = $\frac{.075}{\text{Density}}$ = _____

"k" times { SP = _____" SP; VP = _____" VP; BHP = _____" BHP } at st'd density

average duct velocity = $4000\sqrt{VP}$

= $4000\sqrt{}$

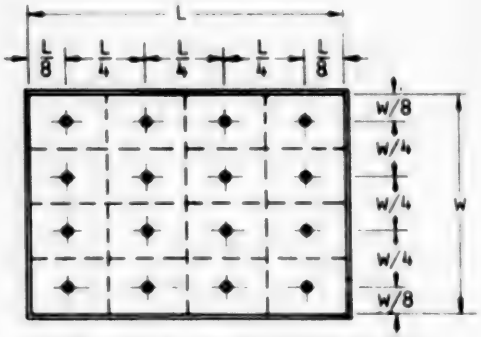
= _____ fpm.

CFM = velocity x duct area

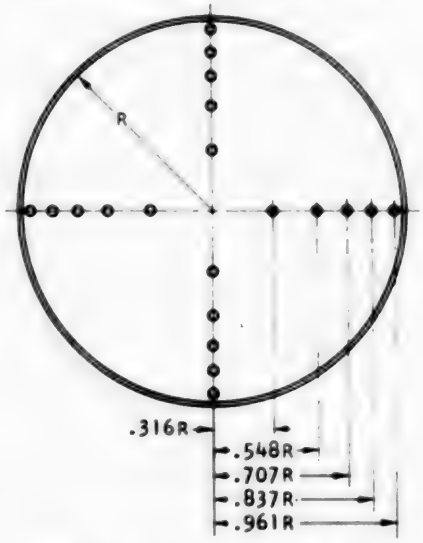
= _____ x _____ = _____ CFM

Add to the SP any loss due to duct friction between points of readings and fan and due to poor inlet and outlet connections.

SKETCH OF INSTALLATION SHOWING POINTS OF READING



PROBE POINTS IN RECTANGULAR DUCT



PROBE POINTS IN ROUND DUCT

7. Locate air volume, static pressure, and horsepower on a fan performance curve drawn at the fan RPM. Such curves may be obtained from the fan manufacturer by supplying him with complete fan nameplate data, RPM, and density.

The plotted values will probably not fall exactly upon the curve. If the fan installation is a good one, the difference should be small, since it will be a reflection only of test inaccuracy. If the difference is great, the system should be analyzed as described in the next section. Fig. 9 shows a typical fan curve and field test points.

What to Look For if The Test Indicates Poor Fan Performance

1. The most frequent cause of poor fan performance is a poor inlet connection. Part 2 of this series dealt with this subject. Poor inlet connections are usually recognizable visually, but can also be demonstrated by inserting a pitot tube through the fan's canvass inlet connection. The pitot tube should be connected to read velocity pressure. Probing the connection carefully with the tube held parallel to the fan shaft will indicate eccentric flow by higher readings on top or bottom or one side.

Twisting the pitot tube slowly back and forth will show at what angle the air is flowing. Maximum velocity pressure readings will be found at the angle at which the tube points directly into the air flow. If maximum values are obtained with the tube angled upward on one side and downward on the other side of the inlet, this indicates spinning flow. Careful observation will show the angle of spin. See Fig. 10. Comparison with an inlet damper characteristic curve will show the loss in capacity attributable to that angle of spin.

2. Compare fan's outlet connection to those described in Part 2 of this series.

3. When determining why a particular fan is not performing as it should, four temperature readings should be made in the vicinity of the fan inlet. It may be necessary to drill four holes in the duct to obtain the temperatures. If more than two degrees variation is found, the air entering is stratified and the effect can easily be similar to that of a poor elbow on the inlet. Be sure to locate the cause of the stratification and remove it, See Fig. 11.

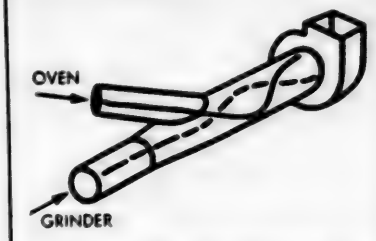


Fig. 11. Condition causing stratification in fan inlet.

How Can Air Flow Be Increased?

If the field test shows the system is handling less than the desired amount of air, there are only two ways of increasing the volume: One is to decrease the static pressure by changing the system, opening dampers, vaning turns, etc.

The other method is to speed up the fan. Without changing the system, an increase in fan speed will yield a directly proportional increase in air volume. However, fan horsepower will increase as the cube of the speed. Thus, an increase of 15% in fan speed will cause 15% more air to flow through the system but will require a 52% increase in horsepower, ($1.15^3 = 1.52$).

Field Test Sheet

The accompanying test form was prepared for field use. It simplifies the tests by providing a place for all of the necessary test data and calculations.

The Series is concluded. Reprints of all five parts will be available.

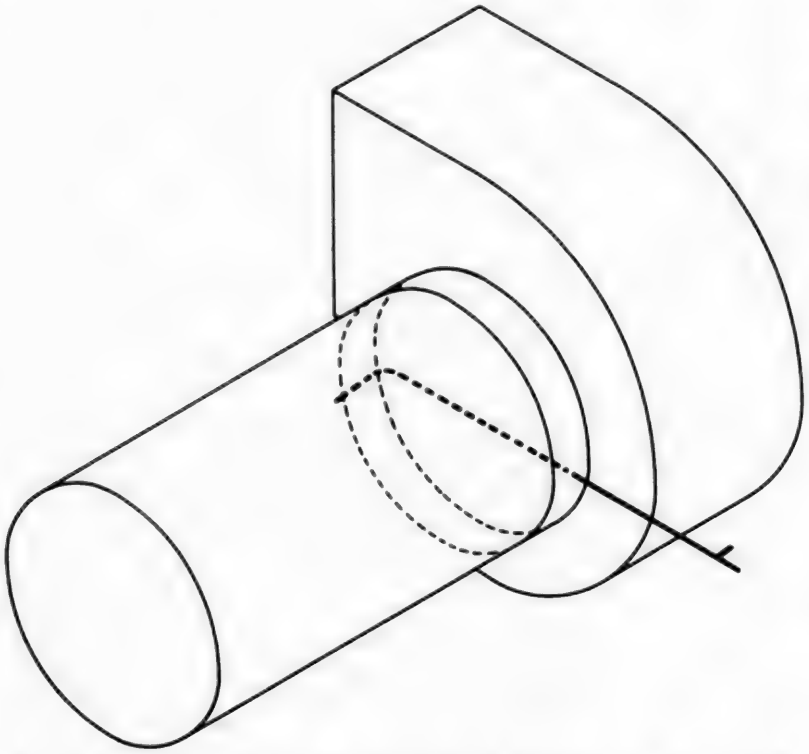


Fig. 10. Probing of fan inlet with pitot tube to determine if spinning air flow is present and if so, the angle of spin.

Reports to NDHA convention show that

District Steam Industry Expands

A. F. METZGER
Supervisor of Steam Utilization, Allegheny County Steam Heating Company, Pittsburgh, Pa.

Abstracts of some of the many papers that were presented at the annual meeting of the National District Heating Association that was held in Asheville, N. C., June 6 to 9. Part I of a two-part report.

THE 51st annual convention of the National District Heating Association held at the Grove Park Inn, Asheville, N. C., June 6 to 9, heard a report made by William C. Kaber of the Sales Development Committee that the district steam industry continues to grow and expand. The report on the new business activities of 49 steam utilities in 1959 showed that 275 new customers were obtained which were estimated to consume 2,774,483,000 lb of steam per year and to return a revenue of $3,238,179 per year. During the same period only 71 customers were lost representing an annual revenue of $221,343. Three cities increased steam generating capacity by a total of about 735,000 lb. per hour, four cities contemplate installing additional capacity in 1960. Thirty-seven companies report adequate capacity for additional new business. Additions or replacements to steam distribution systems were made in 16 cities in 1959 and additions or replacements are planned by 15 cities for 1960.

George F. Prestwich

President G. F. Prestwich presided and the attendance included 140 men and 79 ladies. Officers elected for 1961 are A. F. Metzger, president; J. D. Lemon, 1st vice-president; J. C. Thompson, 2nd vice-president; F. C. Meyer, 3rd vice-president; J. F. Collins, Jr., secretary-treasurer and J. W. Heaton, H. A. Lawrence and A. M. Ritter, directors.

Manpower Requirements

D. H. Brandt, Consumers Power Co., Jackson, Mich., reported the results of a survey made of 51 member steam companies to determine methods used to effect economies in the use of manpower or to reduce manpower requirements. First on the list of methods was the use of automatic controls which materially reduced the number of men required for operation or permitted added capacity without additional manpower. The use of additional or special equipment also reduced manpower requirements.

For instance, the installation of improved water treatment equipment reduced boiler outages and maintenance man-hours. Personnel management improvements resulted in savings by increasing the scope of duties covered by existing jobs. Changes to plants and boilers, installation of tie steam lines etc. permitted existing operating personnel to operate additional capacity. It was shown that at least 12 of the reporting companies have successfully taken definite steps to deter the annual increase in operating and maintenance expense through more efficient and effective utilization of manpower.

Obtaining Steam Air Conditioning Loads

P. R. Dwyer, Detroit Edison Co.; J. W. Megley, Boston Edison Co.; and E. C. Bruce, Consolidated Edison Co. presented separate papers on methods employed in obtaining steam air conditioning loads. Mr. Dwyer showed that the promotion of steam absorption air conditioning in Detroit is assisted greatly by a local code which requires a licensed operator for compression type machines but not for absorption machines. For instance in hospitals a compression refrigeration machine of over 25 hp requires that a second class licensee be within sight or hearing of the machine whenever it is in operation. In other locations, a licensed operator is required, where the horsepower of any single machine is over 125. Therefore the competition is between muliple small electric machines and large absorption machines. The larger operating labor cost on large electric machines gives a definite economic advantage to absorption refrigeration in Detroit.

Mr. Megley showed the effect of market conditions, load factor, climatic conditions, and owning cost on the promotion of steam absorption air-conditioning in Boston but apparently the special steam rate made available for steam air-conditioning four years ago is one of the biggest factors in making this type of air conditioning economically attractive.

Mr. Bruce in his papers said that serious promotion of steam absorption air conditioning in New York started approximately 11 years ago when a promotional steam rate for steam air conditioning was put into effect on September 16, 1949. This rate, which made the energy cost for steam less than electricity, was the beginning of an all-out effort by the company to build-up its summer steam load which was and still is much

New NDHA officers are (seated, left to right) F. C. Meyer, 3rd vice president; J. D. Lemon, 1st vice president; A. F. Metzger, president; G. F. Prestwich, past president and J. C. Thompson, 2nd vice president. Standing l to r, J. F. Collins, Jr., secretary-treasurer; H. A. Lawrence, director; E. T. Smith, director; D. H. Brandt, director and R. H. Swoyer, director. Not present are A. M. Ritter and J. W. Heaton.

less than the winter steam load. At the same time, summer electric load would be steered away from the electric system which was heading for a summer peak, this would require reinforcement of both generating and distribution facilities. The new rate, backed by personal calls on customers, architects and consulting engineers and by extensive advertising, has had great success in promoting steam air conditioning in New York.

Performance of Absorption Equipment

G. Owen Kuhen, Carrier Corp. in his paper outlined the development of the absorption refrigeration machine from the time the basic principles were recognized as early as 1777. Today, he said, absorption machines, using lithium bromide as the absorbent and water as the refrigerant, are made with capacities from 50 tons to 1000 tons. There are several methods of controlling capacity of absorption machines. One is to control the steam flow to the generator, another is to regulate the flow of water through the condenser or a combination of both methods can be used.

The Carrier machine now uses a unique method that directly controls the concentration of the absorbent solution going to the absorber. This method gives a better partial load efficiency than that at full load. Mr. Kuhen showed performance graphs of five different types of refrigeration machines (two types of steam absorption and three types of centrifugal compressors) which clearly showed the strikingly better performance of the solution-controlled absorption machine at partial load.

Regulating Temperature of Domestic Hot Water

W. H. Ambrose, the Detroit Edison Co., in his paper on a new temperature control for instantaneous steam water heaters, gave the reasons for the need for a better control especially one which would not permit the temperature to fluctuate above the set point. The new control consists mainly of a ½-inch self-contained bulb-type thermostatic control steam valve which is used in such a manner that it controls the pressure under the diaphram of the pressure reducing valve (35 to 10 psi) which supplies the heater. The bulb is in the heater hot water outlet line. The ½-inch control valve is in the balance line between the steam pressure regulator and the steam supply line on the low pressure side of the regulator. A ½-inch high pressure connection containing a 3/16-inch orifice is tied into the balance line near the pressure reducing valve.

When the temperature regulator bulb reaches the set temperature, the ½-inch temperature regulator valve closes causing 35 psi. to build up beneath the pressure-regulator diaphragm causing it to close. When the temperature falls slightly, the pressure is relieved a small amount causing the pressure regulator to permit low pressure steam to the heater. This indirect use of the self-contained temperature regulating valve gives a much more uniform temperature than when such a valve is used directly. Temperature recorder charts were shown to show the difference in results of the new control and that of former control methods used.

Steam in Competition with Other Fuels

E. F. McCarrick, Consolidated Edison Co., in his paper stated that the builders of office buildings seldom if ever think of installing their own boiler plants. Apartment builders do not yet universally share this attitude. However, during 1958 and 1959 the Consolidated Edison Co. through advertising and personal contacts, have been successful in persuading the majority of investment apartment builders to take economic advantage of space gained in the basement and up through the building by omitting plants and smokestacks.

Under New City Code, every apartment building with a cite of 10,000 sq ft or more must provide garage space for at least 20 % of its tenants. This makes the omission of a boiler plant more attractive.

The most active areas of apartment building are along Second and Third Avenues. In practically all cases the apartment entrances are on the side streets leaving the avenue frontage for stores. Most of these stores need the basement space beneath. For this reason the owners of many of these buildings find it to their advantage to use basement space for income producing purposes rather than install costly space-consuming boiler plants.

The reason the Consolidated Edison Co. is actively promoting the sale of steam to apartment buildings is threefold; (1) the business is near the steam distribution system; (2) it has a better load-factor (3) most new apartments are prospects for steam absorption air conditioning.

Report to be concluded next month

Tubular Centrifugal Fans Ease Stringency of Computer Room Conditioning Requirements

SEVERE SPACE LIMITATIONS and the requirement for twenty-four hour operation of air conditioning equipment were met by the application of a new tubular centrifugal fan and design of a specially tailored supply system for an electronic computer room installation in the 11-story building of The Travelers Insurance Co., Hartford, Conn.

The entire installation occupies the previously non-air conditioned fourth floor of the building. After placing the computing equipment, there was little space left on this 15,000 sq ft L-shaped floor for fan rooms. A height to the hung ceiling of 9 ft 8 inches imposes an additional restriction on the equipment.

In addition to the "ordinary" computer room requirements of close humidity control, a high degree of air purity, and low noise level, the installation would be operated for sixteen hours each day, and the machines checked during the remaining eight. Thus complete standby air conditioning facilities had to be provided in a very limited space.

Finally, a very flexible system of air distribution was made necessary by the fact that the computer installation would be expanded by the addition of new machines at a later date, and that the location of the greatest heat load varied during the day, as computers were turned on and off.

Air Handling

Conditioned air is supplied from two fan rooms, one of 29,000 cfm, the other, 24,000 cfm capacity, each in former clerical areas on the same floor as the computer room, and adjacent to it. The accompanying drawings of Fan Room No. 2 are typical of both.

Each fan room houses a central air handling apparatus consisting of two of the new tubular centrifugal fans, dry and electrostatic filters, and cooling and reheat coils. Cooling coils get chilled water from two 100-hp centrifugal machines in the penthouse on the roof of the building. Lacking space for sound traps, ducts to computer rooms are lined with approximately 30 ft of acoustical insulation to reduce noise entering the ceiling distribution system in the conditioned area. Return air enters grilles along the corridor wall and is mixed with outside air before the prefilters. To minimize air purification problems, introduction of outside air is kept at a constant minimum.

The fans, made by Turbo-Dynamics (formerly Dryer Electric) Corp., Brooklyn, N. Y., are highly efficient centrifugal fans in tubular housings. See Fig. 1. They take up about half the space of a scroll-type centrifugal. Their straight-through design was particularly useful in this installation, as there was no room for duct elbows in the cramped fan rooms.

Complete standby protection is afforded by the parallel installation of two fans in each fan room. Motors are sized for two times the normal operating load. If one fan or motor has to be shut down for maintenance, the other can carry the entire load. The increase in noise level when so operating is very little. (Because the fans are quiet operating, no acoustical insulation was necessary on the partitions between fan and computer rooms.)

In normal operation, space temperatures are controlled by thermostats in the return air ducts. However, provision is made for the situation when the cooling load is uneven across the space due to idle machines in one area, active machines in another. When this occurs, the occupants can throw a manual switch that transfers control to thermostats strategically located in that portion of the space in use.

New Transistorized Units Added

The original Bizmac installation required specially fabricated fan-coil units attached to each computer as specified by the consulting engineers, and a supply of chilled water to them which removed most of the sensible heat generated by the machines before it had a chance to enter the conditioned space.

The newer RCA 501's are transistorized, so the necessity of special cooling units is eliminated. The 501's require a minimum ambient relative humidity of 30%. Humidifiers in the return air ducts maintain proper humidities, but if, due to mechanical failure, relative humidity should fall to 20%, the humidistat actuates an alarm and annunciator. As a further safety feature, should chilled water supply from the penthouse rise above a critical temperature, another alarm is actuated, so that the machines can be shut off until the source of trouble is found and corrected.

C. G. H. Rogan, partner, and William R. Abbott, project engineer, of Jansen & Rogan, consulting engineers, New York City, were responsible for the design of the mechanical system.

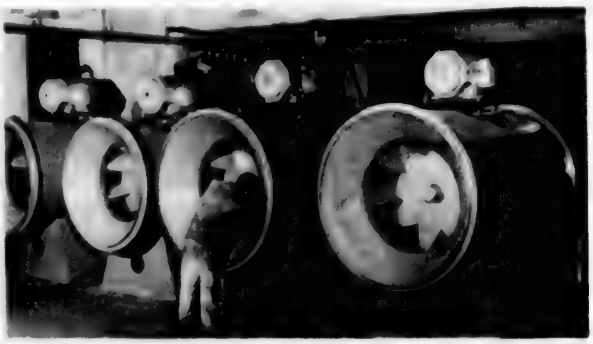
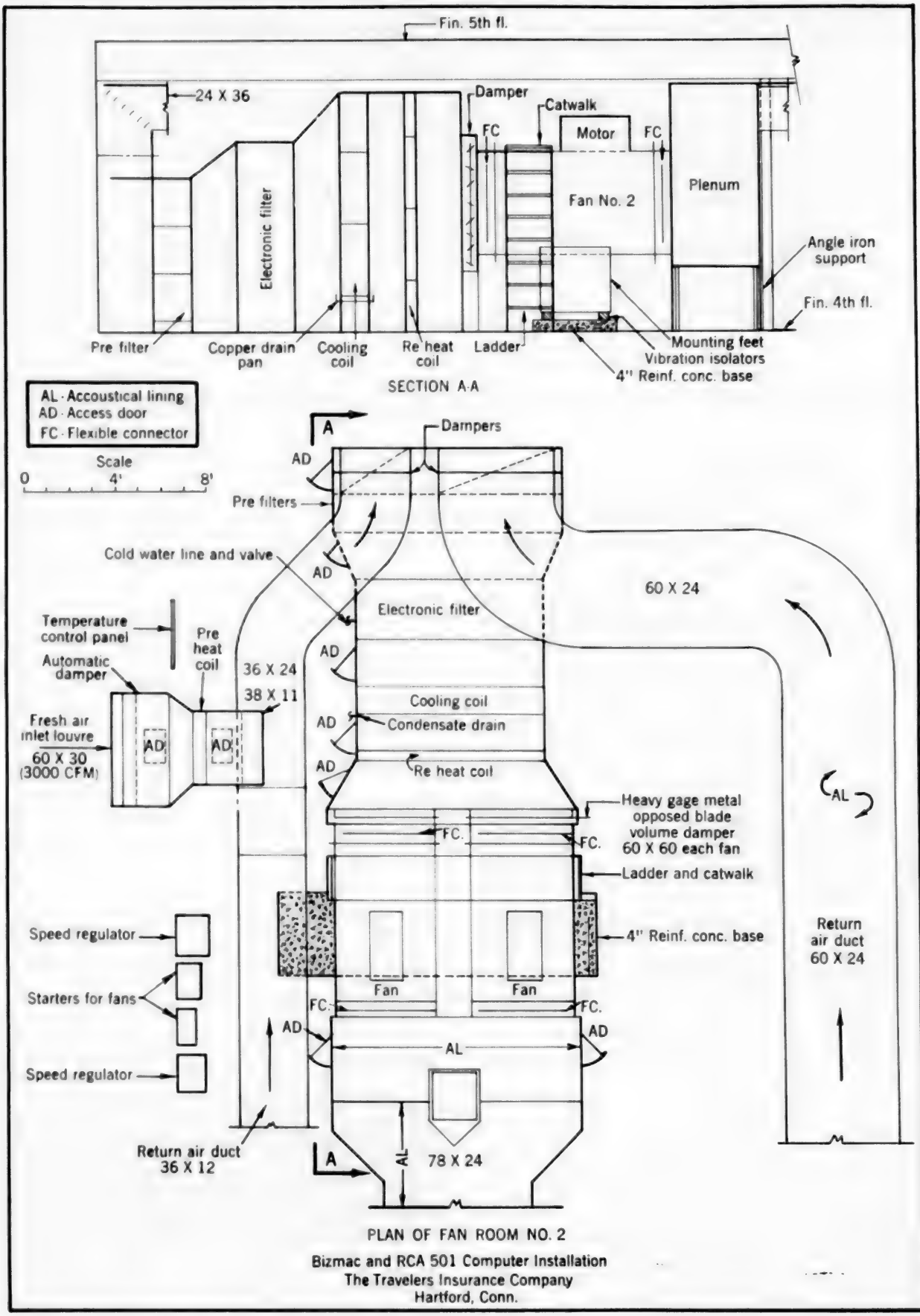


Fig. 1. The fans being readied for shipment to Hartford.



PLAN OF FAN ROOM NO. 2

Bizmac and RCA 501 Computer Installation
The Travelers Insurance Company
Hartford, Conn.

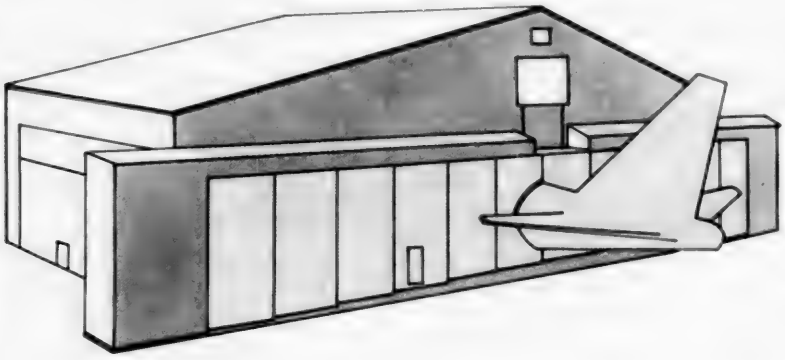


Fig. 1. Nose dock type hangars such as this are housing today's jet-powered bombers and tankers.

Jet-Age Hangars Get Radiant Heating, Snow Melting

NOSE DOCK TYPE HANGARS—designed to shelter power and nose sections of large military jets from winter weather, and permit necessary maintenance on these vital parts—are gaining in use at U. S. Air Force installations.

Many of the hangars, or aircraft maintenance docks, are already in use at Strategic Air Command bases in Delaware, Ohio, Massachusetts, Michigan and New Jersey.

They were designed for housing of the present day jet-powered bombers and tankers. The entire tail assembly—of both bombers and tankers—protrudes through a hole in the hanger door, as shown in Fig. 1, and is exposed to the elements.

Each of the 30-ft high (inside) nose docks contains approximately 20,000 sq ft of floor space and is built in either a square or "T" shaped form for winter protection of B-52 and B-47 bombers, and KC135 and KC99 tankers. This maximum sheltering in a minimum-sized structure—lower and smaller because the high tail section remains exposed—reduces construction costs.

In-the-floor radiant heating provides uniform warmth in the dock and automatic snow melting eliminates snow and ice at the hangar door. Both systems employ networks of wrought iron piping which circulate hot water for heating and a mixture of hot water and anti-freeze for snow melting.

Radiant heating was installed in the nose docks to provide maximum working area, and restore indoor temperature quickly after the hangar is chilled through telescopic doors opening and closing. This provides comfortable temperature for maintenance personnel because the concealed system reduces drafts in the area of most activity. Also, the wrought iron pipe system keeps hangar floor dry by speeding evaporation of water after ice and snow melt from aircraft.

Wallace Process Piping Co., Norfolk, Va., prefabricated Byers 4-D wrought iron grids in 53-ft by 22-ft and 32-ft by 20-ft sections. The metal's high ductility permitted off-the-site fabrication and moving of large grids, reducing costly on-the-job welding. As shown in Fig. 2, each of these grid units was positioned on 18-inch centers on metal supports and enclosed in 8 inches of reinforced concrete. 4-D wrought iron has a coefficient of expansion similar to concrete. Welded joints connect the $1\frac{1}{4}$-inch dia piping to 2-inch wrought iron headers.

In operation, water is heated and is pumped at 130 deg F through the pipe network at a rate of 150 gpm. Planned to offset the heat loss in each nose dock, the radiant heating system will maintain a 70-deg temperature.

Supplementing radiant heating at the hangar door is an automatic snow melting system which includes a 170 by 5-ft network of identical wrought iron piping, also made by A. M. Byers Co., Pittsburgh. This system prevents the telescoping door from freezing tight or jamming, and eliminates time-consuming shoveling of drifts and other, smaller snow and ice accumulations.

Fig. 2. Wrought iron pipe grids, prefabricated in 53 by 22-ft units, are positioned as part of a nose dock radiant heating system.

To provide clear and dry pavement during winter months, a 130-deg solution of water and triethylene glycol will circulate through 1-inch dia pipe grids and 1½-inch headers at 50 gpm.

Southern, Waldrip and Harwick, Long Beach, Calif., designers and general contractor, sub-contracted mechanical construction of the nose docks to Wallace Process Piping Co. All wrought iron pipe was supplied through Central Jersey Supply Co., Perth Amboy, New Jersey.

Six of these docks were erected at Clinton County Air Base in Wilmington, Ohio, and a similar number at Selfridge Air Force Base in Mount Clements, Mich. At three other bases—McGuire AFB, Wrightstown, N. J.; Dover AFB, Dover, Del., and Otis AFB, Falmouth, Mass.—there are nine of these unusually designed aircraft maintenance structures. Others are planned for Richard I. Bong AFB, Madison, Wis.; Evreaux AFB, France; Dow AFB, Bangor, Maine; and many other SAC bases.

Stainless Steel Sheathes Mechanical Service Core

PITTSBURGH IS GROWING a family of stainless steel skyscrapers. The gleaming new Four Gateway Center building, dedicated on June 24, 1960, joins the three towering office buildings constructed at the Center eight years ago. All the buildings use stainless steel as the prime construction material. The new building alone utilizes nearly a half-million pounds of the corrosion-resisting metal for mullions, the service core, and ground-floor entrances.

The exterior of Four Gateway Center is an attractive combination of stainless steel mullions and green-tinted glass forming unbroken vertical lines the full height of the 22-story structure. Limbach Company, Pittsburgh, fabricated some 3800 mullion sections from 16-gage, Type 302 stainless for its properties of strength, lightness, beauty and easy maintenance.

Functionally, the window-less service core, seen on the extreme right in photo at right, provides the main building with unobstructed floor areas totalling 400,000 sq ft of space. In addition to elevators, the stainless-sheathed service core contains reheat coils and ducts on each floor for the interior air conditioning system, plus chilled water supply and return lines, and steam and condensate lines. Chilled water for the air conditioning system comes from a central refrigerating source in the nearby Three Gateway Center building. Also in the service core are toilets for the entire building, electrical conduits, and cold water lines for the drinking fountains.

The service core's outside wall area of 43,000 sq ft is completely protected by stainless steel panels. For contrast and emphasis, three-inch-wide vertical strips of gray-colored stainless steel are set into the indented center of each panel, and between the panels themselves. The strips are colored with a modified acrylic resin. Colored stainless steel is a comparatively recent development which offers the architect, as in the case of Four Gateway Center, greater opportunity for design variations. The gray-accented stainless steel service core and the stainless-and-glass curtain wall blend perfectly to give the overall structure a balanced attractiveness.

The three original Gateway Center buildings are stainless steel curtain wall structures and were the pioneers in Pittsburgh's extensive post-World War II urban renewal program. A few months ago, these buildings were given a complete face cleaning for the first time since their construction. The stainless exteriors emerged as bright as when originally installed. This fact was an added reason for extensive use of stainless steel on the new building.

All the Gateway Center buildings are owned and operated by Equitable Life Assurance Society. For the new structure, Harrison & Abramovitz, of New York City, were the architects, and George A. Fuller Company was general contractor.

Louis Blendermann on

PLUMBING and PIPING

Gasoline Station Drainage

ONE type of building that is being erected widely is the gas station. Old buildings are being razed and new buildings are being erected in their place, in addition to entirely new stations.

The gasoline station is a basic structure and its prime purpose is to dispense gasoline, oil and in general, provide the minor repairs and service required by the average car owner.

The tourist regards a particular gas station chain by its courtesy and personalized attention, plus the sanitary aspects of its rest rooms. However, we shall confine the discussion of this article to the floor drains that are installed in the designated service area of the gas station.

The service area generally consists of a two-compartment space. One space includes a lift and is devoted to greasing or under-car repairs; the other half is used for car washing or repairs of a general nature. When the gas station is of larger capacity, more compartments are added.

Typical Gas Station

For the sake of reference in this article, a typical gas station has been shown for example in Fig. 1. The station consists of an office space or sales area, toilet rooms, storage area, utility room and service area. Two floor drains have been included in the service area and connect with the sanitary drainage line as shown.

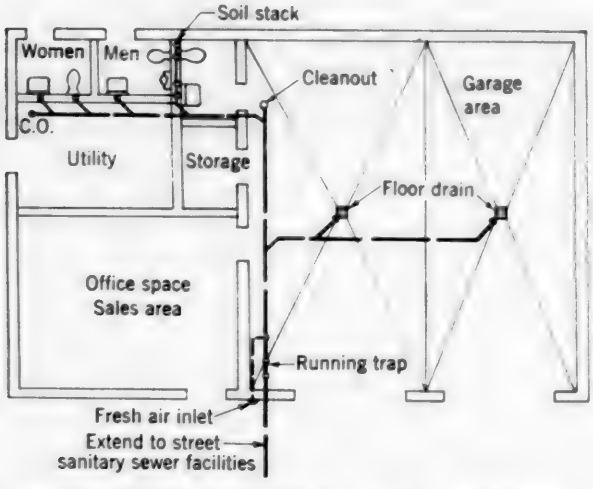


Fig. 1. Suggested arrangement of floor drains for a typical gas station.

The floor drains are primarily intended for draining the water used in washing the floor area. The other drain handles water dispensed by the car washing apparatus.

Volatile Liquids

Unfortunately, a potential hazard exists in the service area. Oil and grease dripping from cars are washed into the drains when the floor of the service area is hosed down. A can of used motor oil might be carelessly discharged into one of the drains. Quite often, gasoline or other volatile liquids are used to clean parts of a car and this liquid, too, may be carelessly discharged into one of the drains.

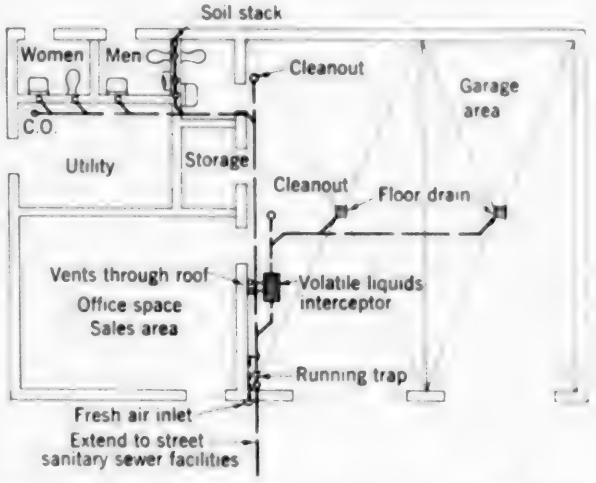


Fig. 2. Arrangement of floor drains and volatile liquids interceptor.

All these factors represent a potential hazard in the floor drains and the underground piping system. Serious explosions and fires can and have resulted from accumulations of the volatile liquids. Many plumbing codes now require that some means of protection must be afforded so as to intercept and retain the volatile liquids. One such means of protection is the volatile liquids interceptor.

Volatile Liquids Interceptor

In gas stations, the inclusion of a volatile liquids interceptor could be similar to that shown in Fig. 2. The underground drainage lines are, in general, installed in the same manner as that shown in Fig. 1.

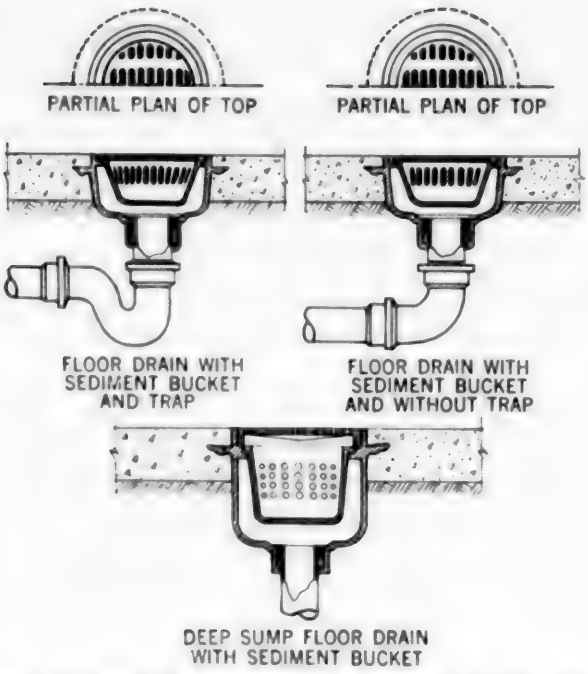

PARTIAL PLAN OF TOP
PARTIAL PLAN OF TOP
FLOOR DRAIN WITH SEDIMENT BUCKET AND TRAP
FLOOR DRAIN WITH SEDIMENT BUCKET AND WITHOUT TRAP
DEEP SUMP FLOOR DRAIN WITH SEDIMENT BUCKET

Fig. 3. Details of drains that can be used in gas stations.

The exception to this kind of installation is the volatile liquids interceptor that is installed to serve the floor drains.

The interceptor is installed in an out-of-the-way location where it can be easily maintained. When properly installed, this unit will intercept and retain for easy removal, any volatile liquids that are accidentally or carelessly discharged into the floor drain system, and this type of system will be discussed later in more detail.

Floor Drains

Floor drains must be carefully selected for a service area in a gas station and must possess the following important features:

1. The grate should be of sufficient strength to withstand the weight of a car passing over it.

2. The drain and opening should be of adequate size to facilitate rapid drainage.

3. The drain should be equipped with the means to intercept grit and debris.

Three commonly used floor drains are illustrated in Fig. 3.

The first drain shown in Fig. 3 includes a sediment bucket and is equipped with a P-trap. Slots in the side of the bucket and small openings in the bottom permit complete drainage of the waste water but retain coarse sediment and debris. The trap offers a water seal to prevent sewer gases from emitting at the drain. Venting of the floor drains must be accomplished in accord and with the requirements of the local code. A trapped floor drain is used when an interceptor is not placed in the line.

The second drain is similar to the first with the exception that the trap has been omitted, as would be the case when a volatile liquids interceptor is included in the system. A feature of both drains is the arrangement of grate and sediment bucket. The grate cannot be set in position unless the bucket is in place. This feature avoids the possibility of neglecting to replace the bucket after a cleaning operation.

The third drain is a deep sump type floor drain and includes a large capacity type sediment bucket. This drain, too, can be installed with or without a trap. The grate is of a heavy duty type to withstand the heavy loads to which it will be subjected. The bucket is of large capacity to intercept the large volume of sediment and debris that is washed into the drain. This sediment and debris is the matter that adheres to the underside of cars and enters the drain when the floor is washed.

Such debris can enter the drain and cause partial or complete stoppages in the underground drainage piping for it will accumulate in a portion of the piping, and will harden like concrete. With sufficient build-up, it will retard the flow of the waste water. Therefore, attention must be given to the interception and retention of this debris to prevent entrance to the underground drainage piping.

There are many other styles and shapes of drains that may be utilized in the service area of a gas sta-

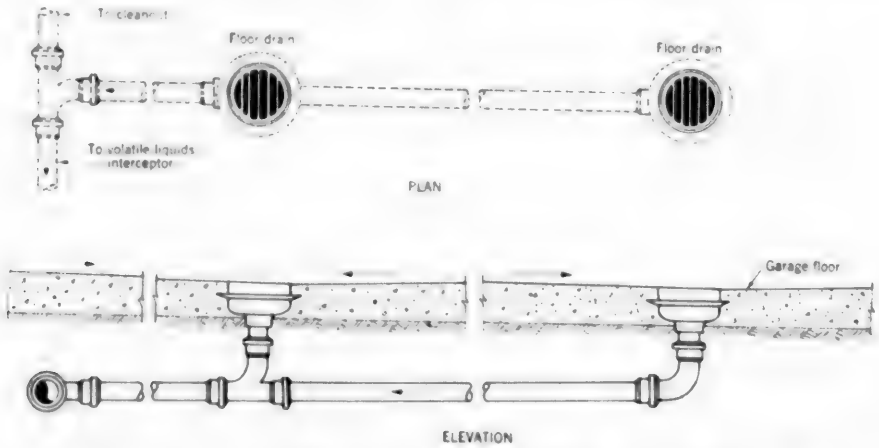


Fig. 4. Arrangement of floor drains, piping and the necessary floor slope.

tion with equal success to the ones that are illustrated as examples.

Slope of Floor

Quite often, the proper slope of the floor in the service area of a gas station is overlooked. When this situation prevails, the water dispensed on the floor does not readily drain to the floor drains and the floor remains wet for a longer period of time. It is highly recommended that the floor be sloped in a positive manner toward the drains. For example, see Fig. 4.

Note the definite slope of the floor toward the drains. The underground drainage line receiving the discharge from the floor drains should be sloped with a ¼ inch pitch to facilitate the drainage. This is an important consideration, especially when car washing facilities are used. The contractor, in running his sanitary line to the street sewer must maintain a slope that will permit his line to connect with the street facilities at a proper elevation. Thus the slope of floor and underground drainage line are important considerations and the contractor should make sure that both are done with utmost care.

Volatile Liquid Interceptors

When a volatile liquid interceptor is employed, it can be installed similar to that shown in Fig. 5. The interceptor in this instance is equipped with an extension to allow the top of the unit to be flush with the floor surface. If an extension is not desired, then the interceptor must be installed in a pit with a frame and cover at the top of the pit to offer access to the interceptor cover. The usual reason for the extension is the difficulty in attaining the proper elevation between intercepor inlet and underground drainage piping.

The interceptor is equipped with two vent connections at its side. These vent connections are extended up through the roof of the building and terminate at different degrees of elevation. The difference in elevation is usually 6 to 12 inches. The vent lines will relieve any explosive gases that accumulate in the interceptor, thereby avoiding a potentially hazardous condition.

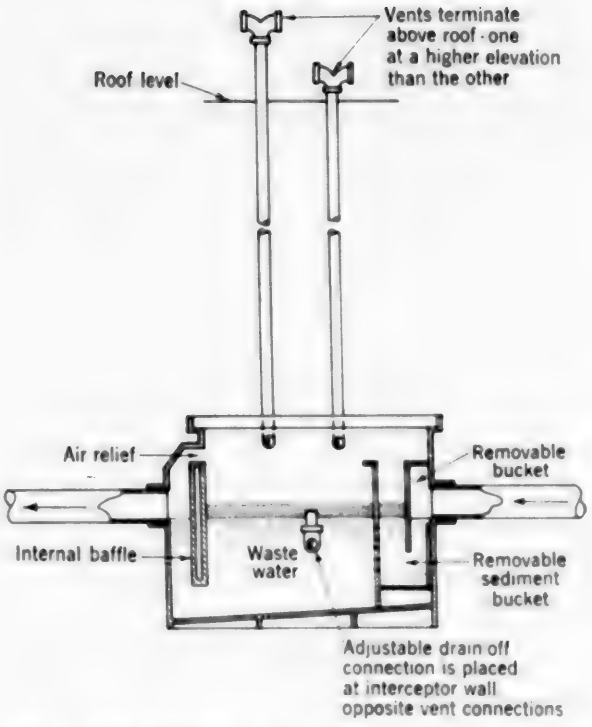

Vents terminate above roof - one at a higher elevation than the other
Roof level
Air relief
Removable bucket
Internal baffle
Waste water
Removable sediment bucket
Adjustable drain off connection is placed at interceptor wall opposite vent connections

Fig. 6. Basic operation of an oil interceptor and how this unit is vented.

A natural circulation of air is accomplished by the difference in elevation of the vent terminals. Wind velocity over the roof of the building will vary at each elevation of vent terminal thus creating an unbalance of atmospheric pressure in the vent lines. Therefore, the lighter than air explosive gases will relieve through one vent and air will be drawn through the other. This is a system of natural air circulation.

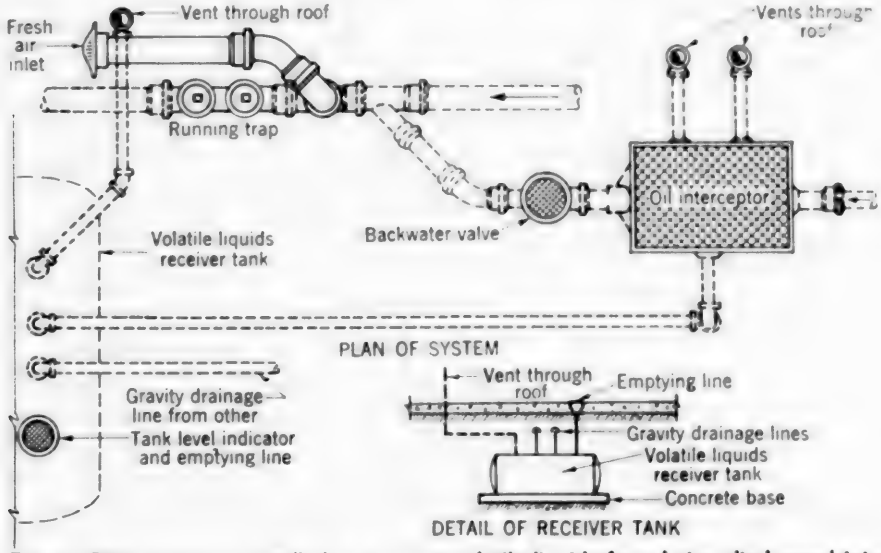


Fig. 5. Oil interceptor installed to prevent volatile liquids from being discharged into the sanitary system.

The waste water discharge from the interceptor passes through a backwater valve. The purpose of the backwater valve is to prevent any possiblity of sewerage backflow from entering the interceptor. The local plumbing code should always be consulted with regard to the arrangement of the interceptor and required venting before the installation proceeds too far.

If possible, there should be a difference in elevation between the outlet from the interceptor and the elevation of the sanitary line to which it connects. Figure 5 suggests the details of this arrangement.

Cross Section Through Interceptor

Figure 6 shows a section through the interceptor.

The extension on top of the interceptor that had been included in Fig. 5, has been omitted for the sake of clarity. Here is how the unit functions. Waste water from the floor drains enters the interceptor and a baffle reduces its turbulence. A sediment bucket traps any minute quantities of sediment or debris that is carried by the water. The sediment bucket is perforated to retain the foreign matter and allow the waste water to pass through.

In the settling chamber, the volatile liquids will separate from the water and float to the surface while the clear waste water will pass under the last baffle and discharge into the sanitary system. The air relief shown at the outlet baffle assures the balance of air needed for the proper discharge of waste water from unit. The two vent lines extend up through the roof to terminate in a manner shown in Fig. 5.

The draw-off connection shown is used when it is desired to drain the volatile liquids to a volatile liquids receiver tank. An adjustable tube in the fitting is set at an elevation that is slightly higher than the flood level of the waste water passing through the interceptor. The contractor can determine the exact level by trial, once the unit is installed.

The interceptor shown in Fig. 6, is of a generalized shape and is only intended for example in describing the basic operation of the unit. Several manufactured types, each with specific refinements are available for the purpose. The covers too, are secured in a manner relative to each unit.

Receiver Tanks

When it is desired to provide a draw-off connection at the interceptor, the piping arrangement might be similar to that shown in Fig. 7. Note that a draw-off line is extended from the interceptor to a receiver tank, which is located just outside of the building structure. This tank, very often, is also used for the waste oil drained from automobiles in the service procedure.

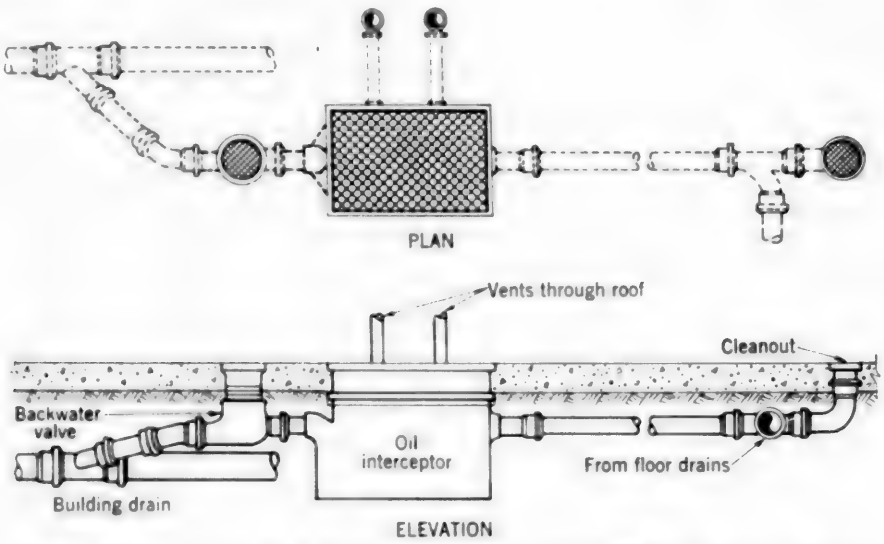


Fig. 7. Arrangement of oil interceptor, piping and volatile liquids receiver tank.

The tank is supported on a concrete pad and is in fact, secured to the pad. At least one vent line must be extended from the tank to the atmosphere. Two vents will serve to the same advantage as that described for the interceptor.

A test line is extended to grade level and serves to indicate the level of the liquid contained in the receiver tank. This is accomplished by inserting a rod into the tank. This line is also used for sucking out the contents of the tank.

It is very important that the proposed installation be discussed with the local plumbing authorities to gain their exact requirements. The intended capacity of the interceptor and the receiver tank are determined on the basis of the amount of water that will be discharged into the floor drains. These units must be properly sized.

When properly sized, installed and maintained, the system will serve the needs of the gas station in a very adequate manner and more important, will safeguard the gas station from the potential hazard that exists when volatile liquids are handled.

DEGREE-DAYS FOR JUNE, 1960

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

City	June			Season to June 30, incl., from Sept. 1		
	1960	1959	Normal	1959-60	1958-59	Normal
Abilene, Texas (A)	0	0	0	3048	2834	2707
Albany, New York (A)	32	68	50	6634	7204	6938
Albuquerque, New Mexico (A)	0	0	0	4286	4117	4389
Alpena, Michigan (C)	177	105	135	8498	8146	7938
Anchorage, Alaska (A)	289	245	339	9960	10744	10259
Asheville, North Carolina (C)	2	3	5	4509	4078	4072
Atlanta, Georgia (A)	0	0	0	3226	2797	2826
Atlantic City, New Jersey (C)	12	23	24	4743	5156	4741
Augusta, Georgia (A)	0	0	0	2830	2484	2138
Baltimore, Maryland (C)	0	6	0	4263	4224	4203
Billings, Montana (A)	53	68	119	7068	6902	7078
Binghamton, New York (C)	43	67	48	6056	6882	6520
Birmingham, Alabama (A)	0	0	0	3093	2839	2788
Bismarck, North Dakota (A)	83	56	116	8953	9042	8967
Block Island, Rhode Island (A)	37	112	96	5484	5915	5816
Boise, Idaho (A)	23	43	92	6402	5297	5890
Boston, Massachusetts (A)	(a)	92	42	(a)	5962	5784
Buffalo, New York (A)	48	63	72	6598	6867	6792
Burlington, Iowa (A)	14	9	34	6607	6231	6101
Burlington, Vermont (A)	81	97	72	7576	8152	7799
Cairo, Illinois (C)	0	0	0	4344	3887	3756
Charleston, South Carolina (C)	0	0	0	2203	1851	1769
Charlotte, North Carolina (A)	0	0	0	3512	3203	3205
Chattanooga, Tennessee (A)	0	0	0	3864	3549	3384
Cheyenne, Wyoming (A)	89	71	173	7309	7175	7490
Chicago, Illinois (A)	30	12	58	6400	6261	6310
Cincinnati, Ohio (C)	0	0	0	4798	4467	4532
Cleveland, Ohio (A)	58	43	46	6166	6061	5996
Columbia, Missouri (A)	1	3	14	5629	4974	5107
Columbia, South Carolina (A)	0	0	0	2936	2614	2284
Columbus, Ohio (C)	2	20	22	5497	5502	5277
Concord, New Hampshire (A)	69	107	82	6877	7592	7544
Concordia, Kansas (C)	8	8	20	6107	5334	5323
Dallas, Texas (A)	0	0	0	2793	2444	2272
Denver, Colorado (A)	38	25	65	6254	5830	6116
Des Moines, Iowa (A)	13	15	45	7186	6519	6429
Detroit, Michigan (A)	43	34	60	6373	6457	6396
Devils Lake, North Dakota (C)	118	90	137	10312	9843	9832
Dodge City, Kansas (A)	13	3	15	5652	5117	5058
Dubuque, Iowa (A)	57	26	76	7774	7535	7235
Duluth, Minnesota (A)	204	185	200	9843	9870	9417
Elkins, West Virginia (A)	(a)	(a)	53	(a)	(a)	5733
El Paso, Texas (A)	0	0	0	2514	2409	2641
Ely, Nevada (A)	86	98	200	7628	6955	7377
Escanaba, Michigan (C)	156	103	166	8394	8683	8500
Evansville, Indiana (A)	5	0	6	5100	4689	4360
Fairbanks, Alaska (A)	261	135	193	13567	14726	13713
Fargo, North Dakota (A)	87	63	101	9413	8969	9208
Fort Smith, Arkansas (A)	0	0	0	3815	3423	3188
Fort Wayne, Indiana (A)	35	27	53	6493	6410	6270
Fort Worth, Texas (A)	0	0	0	2855	2553	2361
Fresno, California (A)	0	0	0	2392	2032	2532
Galveston, Texas (C)	0	0	0	1573	1332	1211
Grand Junction, Colorado (A)	0	0	0	5753	5076	5796
Grand Rapids, Michigan (A)	65	27	79	6932	7071	7027
Green Bay, Wisconsin (A)	124	72	107	8286	8421	8169
Greensboro, North Carolina (A)	0	2	0	4247	3910	3810
Greenville, South Carolina (A)	0	0	0	3542	3067	3060
Harrisburg, Pennsylvania (A)	3	23	14	5246	5376	5258
Hartford, Connecticut (A)	28	82	31	5943	6443	6125
Havre, Montana (C)	98	78	125	8172	8278	8155
Helena, Montana (A)	134	126	197	8306	8070	8202
Houston, Texas (C)	0	0	0	1655	1430	1276
Huron, South Dakota (A)	53	20	80	8763	7913	7876
Indianapolis, Indiana (A)	24	6	30	6051	5766	5611
Jackson, Mississippi (A)	0	0	0	2861	2500	2202
Juneau, Alaska (A)	409	285	342	7670	8339	8234
Kansas City, Missouri (A)	2	0	8	5363	4613	4888
Knoxville, Tennessee (A)	0	0	0	4027	3637	3590
La Crosse, Wisconsin (A)	57	33	74	7614	7719	7619
Lander, Wyoming (A)	67	74	163	(a)	7655	8273
Lewiston, Maine (O)	70	169	45	6903	7702	7707

(a) Data not available.
* Figures based on Airport readings.
** Figures based on City office readings.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of the Coke Sales Department, Cntral New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively.

Degree-Days for June, 1960 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

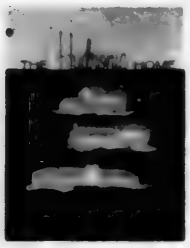
AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

City	June			Season to June 30, incl., from Sept. 1		
	1960	1959	Normal	1959-60	1958-59	Normal
Lincoln, Nebraska (C)	11	14	32	6695	5697	5858
Little Rock, Arkansas (A)	0	0	0	3541	3034	2982
Los Angeles, California (C)	0	0	0	913	707	1451
Louisville, Kentucky (A)	6	0	5	4748	4729	4439
Lynchburg, Virginia (A)	1	11	5	4518	4171	4153
Macon, Georgia (A)	0	0	0	2583	2173	2049
Madison, Wisconsin (A)	77	32	79	7864	7701	7260
Marquette, Michigan (C)	199	145	189	8535	8413	8373
Memphis, Tennessee (A)	0	0	0	3589	3219	3137
Meridian, Mississippi (A)	0	0	0	2890	2577	2333
Milwaukee, Wisconsin (A)	132	73	109	7554	7475	7153
Minneapolis, Minnesota (A)	82	28	80	8169	7594	7828
Moline, Illinois (A)	13	8	45	6920	6450	6356
Montgomery, Alabama (A)	0	0	0	2514	2173	2137
Nashville, Tennessee (A)	0	0	0	4223	3757	3513
New Haven, Connecticut (A)	18	68	52	5588	6054	6008
New Orleans, Louisiana (C)	[illegible]	[illegible]	0	1558	1298	1175
New York, New York (C)	0	43	18	4935	5153	5050
Newark, New Jersey (A)	0	27	11	4844	5179	5252
Norfolk, Virginia (A)	1	4	0	3566	3343	3454
North Platte, Nebraska (A)	48	22	59	7426	6645	6529
Oak Ridge, Tennessee (C)	0	0	(a)	4210	3916	(a)
Oakland, California (A)	56	70	119	2429	2137	3002
Oklahoma City, Oklahoma (A)	0	0	0	4255	3887	3519
Omaha, Nebraska (A)	12	14	32	6908	6097	6155
Parkersburg, West Virginia (C)	3	23	13	5097	5023	4750
Peoria, Illinois (A)	18	5	41	6658	6112	6076
Philadelphia, Pennsylvania (C)	2	12	0	4436	4632	4523
Phoenix, Arizona (A)	0	0	0	1451	1115	1492
Pittsburgh, Pennsylvania (C)	6	30	13	5185	5288	5048
Pittsfield, Massachusetts (A)	101	114	105	7226	7699	7606
Pocatello, Idaho (A)	(a)	75	136	(a)	6358	6976
Portland, Maine (A)	89	187	117	7135	7872	7610
Portland, Oregon (C)	69	84	70	4294	3815	4116
Providence, Rhode Island (A)	30	[illegible]	[illegible]	5748	6161	6099
Pueblo, Colorado (A)	7	10	27	6092	5410	5709
Raleigh, North Carolina (A)	2	4	0	3870	3550	3075
Rapid City, South Dakota (A)	58	47	148	7817	6988	7479
Reading, Pennsylvania (C)	1	16	11	4971	5153	5055
Red Bluff, California (A)	0	0	[illegible]	2476	1920	2546
Reno, Nevada (A)	42	58	165	6051	5489	5948
Richmond, Virginia (A)	2	10	0	4213	3923	3955
Rochester, New York (A)	56	67	54	6829	7040	6820
Roswell, New Mexico (A)	0	0	0	3628	3551	3424
Sacramento, California (C)	0	0	5	2335	1827	2600
St. Joseph, Missouri (A)	4	3	11	6123	5426	4703
St. Louis, Missouri (C)	1	0	7	5053	4519	4469
Salt Lake City, Utah (A)	14	34	81	6156	5297	5866
San Antonio, Texas (A)	0	0	0	1947	1768	1579
San Diego, California (A)	4	0	43	1010	701	1556
Sandusky, Ohio (C)	17	11	41	6045	6092	5859
San Francisco, California (C)	176	165	180	2299	2062	2703
Sault Ste. Marie, Michigan (A)	227	167	224	9030	9398	9240
Savannah, Georgia (A)	0	0	0	2276	1884	1710
Scranton, Pennsylvania (A)	29	55	35	6289	6547	6029
Seattle, Washington (C)	109	104	107	4323	4102	4344
Sheridan, Wyoming (A)	73	83	161	7785	7705	7835
Shreveport, Louisiana (A)	0	0	[illegible]	2742	2392	2117
Sioux City, Iowa (A)	15	21	54	7727	6839	6987
Spokane, Washington (A)	118	131	146	7294	6504	6807
Springfield, Illinois (A)	14	2	14	6079	5568	5225
Springfield, Missouri (A)	0	9	16	5167	4598	4685
Syracuse, New York (A)	47	66	37	6561	7082	6491
Toledo, Ohio (A)	62	31	60	6609	6508	6382
Topeka, Kansas (C)	3	4	13	5906	5194	4919
Trenton, New Jersey (C)	3	23	11	4883	5171	5068
Tulsa, Oklahoma (A)	0	0	0	4195	3606	3584
Utica, New York (O)	28	59	0	6170	6942	6796
Valentine, Nebraska (A)	47	33	83	7959	7224	7054
Walla Walla, Washington (C)	34	31	38	5231	4586	4848
Washington, D. C. (A)	0	11	0	4270	4213	4258
Wichita, Kansas (A)	1	0	7	5198	4689	4571
Williston, North Dakota (C)	117	65	138	9126	8915	8997
Winnemucca, Nevada (A)	22	61	111	6704	6099	6352
Yakima, Washington (A)	70	101	53	6335	5905	5838

For footnotes see page 104

NEW LITERATURE

Use the prepaid postcard on last page for securing your copies of these catalogs.



The Hydronic Home

The hydronic home is the theme of a 20-page booklet published by Bell & Gossett Co., Morton Grove, Ill., to illustrate how a modern, circulated water system for heating and cooling can provide all-weather comfort plus additional benefits such as labor-saving snow melting.

Circle **Item 1** on Inquiry Card

One-Piece Pipe Insulation

Thermal and physical characteristics of Mono-Kover, a one-piece pipe insulation for service from below zero to 350 deg F, are described in a technical bulletin published by Baldwin-Ehret-Hill, Inc., Trenton, N. J. The 4-page bulletin also illustrates the mineral fiber material's ease of use.

Circle **Item 2** on Inquiry Card

Finned Tube Radiation

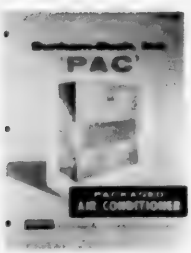
Sunnywall Type N finned tube radiation is designed to meet the requirements of modern buildings where maximum heat output is necessary but only a minimum amount of space is available. A 24-page descriptive catalog, from Crane Co., Johnstown, Pa., gives complete ratings.

Circle **Item 3** on Inquiry Card

Modular Plastic Diffuser

Its modular plastic diffuser is described by Carnes Corp., Verona, Wis., as a new concept in air distribution equipment resulting from extensive studies. Forty-page Catalog No. 460 describes the application of this diffuser, and presents useful engineering and performance data.

Circle **Item 4** on Inquiry Card



Packaged Air Conditioner

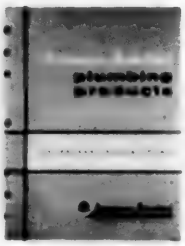
Dunham-Bush, Inc., West Hartford, Conn., has issued a 12-page manual on its "PAC" packaged air conditioner line. Manual includes product details and cutaway illustration, plus technical information such as specifications, ratings, piping and wiring diagrams, dimensions.

Circle **Item 5** on Inquiry Card

Centrifugal Fan Cooling Towers

A 4-page bulletin on its two series of centrifugal fan cooling towers is offered by Halstead & Mitchell Co., Pittsburgh, Pa. Bulletin ECKB-601 contains charts and tables showing operating and dimensional data, and cooling tower capacities at various wet bulb temperatures.

Circle **Item 6** on Inquiry Card



Plumbing Products

A 32-page condensed catalog (PT60) of plumbing products from American-Standard Plumbing & Heating Div., New York, N. Y., emphasizes residential and small commercial equipment. Catalog has fixtures and fittings co-ordinated on each page for complete and easy reference.

Circle **Item 7** on Inquiry Card

Fractional Horsepower Motors

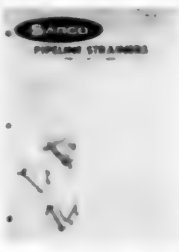
A 12-page catalog illustrates and describes the complete line of fractional horsepower electric motors, blowers, replacement kits, brackets, fan blades and accessories available from Redmond Co., Inc., Owosso, Mich. Dimensional diagrams, horsepower range charts are included.

Circle **Item 8** on Inquiry Card

Solar Screens

A 4-page brochure, illustrating some of the many design combinations possible with Sol-R-Wall solar screens, is announced by the manufacturer, Malvern Flue Lining, Inc., Malvern, Ohio. The brochure includes suggestions for solar screen walls or panels, indoors or out.

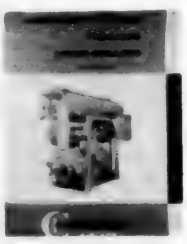
Circle **Item 9** on Inquiry Card



Pipeline Strainers

Four basic types of pipeline strainers for condensate, steam, water, oil, air and gas are covered in 4-page Bulletin No. 1210, published by Sarco Co., Inc., New York, N. Y. Bulletin presents construction and operating features of these Y-type strainers designed to protect piped equipment.

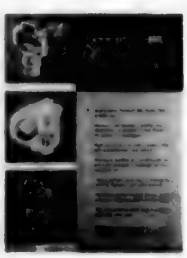
Circle **Item 10** on Inquiry Card



Packaged Liquid Chillers

Packaged liquid chiller units, from Airtemp Div., Chrysler Corp., Dayton, Ohio, supply chilled water for every type of central air conditioning system with a range of capacities from 15 to 125 hp. Twenty-page catalog (ME 123) describes these units and gives all necessary selection data.

Circle **Item 11** on Inquiry Card



Steam Traps

An 8-page steam trap catalog is offered by MIL Div., Farris Engineering Corp., Palisades Park, N. J. Catalog FE-310 provides detailed information about the Farris MIL line of low-cost, bi-metal thermostatic and float thermostatic steam traps, available in a variety of pressure ranges.

Circle **Item 12** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Air Intake Units

Covering gas and steam-fired air intake units and unit heaters, a 12-page bulletin (A-117) is issued by Hartzell Propeller Fan Co., Piqua, Ohio. A wide range of sizes, construction options and accessories permits exact matching of make-up air requirements.

Circle **Item 13** on Inquiry Card

Meters, Feeders and Controls

B-I-F Industries, Providence, R. I., has published an 8-page general bulletin which provides capsule information about many of its products and systems. Butterfly valves, supervisory control systems, totalizing meters, water and waste treatment equipment and systems are covered.

Circle **Item 14** on Inquiry Card

Industrial Combustion Equipment

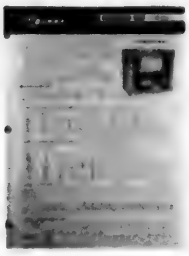
An 8-page catalog describing gas combustion and control equipment for industry is announced by Bryant Industrial Products Corp., Cleveland, Ohio. Catalog describes every type of burner, mixer, pilot, regulator, blower, valve and accessory made by company, and includes applications.

Circle **Item 15** on Inquiry Card

Cooling Water Treatment

Hagatreat Formula No. 168, a corrosion inhibiting compound for treatment of recirculating cooling water systems, is the subject of a 4-page bulletin issued by Calgon Co., div. of Hagan Chemicals & Controls, Inc., Pittsburgh, Pa. It is said to provide complete corrosion control.

Circle **Item 16** on Inquiry Card



Packaged Blowers

A 4-page specification bulletin describing its Series K packaged blowers is published by Reznor Manufacturing Co., Mercer, Pa. Described are both the Model K1 unit, with one blower, and the Model K2, with two blowers. Units are designed to match Reznor's gas-fired duct furnaces.

Circle **Item 17** on Inquiry Card

High Temperature Water Generators

Boiler Div., The Babcock & Wilcox Co., Barberton, Ohio, announces a 36-page booklet describing operation and applications of the two basic high temperature water systems designed by B&W to utilize low-cost conventional water tube steam boilers or forced circulation boilers. Company asks that you request Bulletin G-92 on your company letterhead.

General Purpose Valves

A 40-page catalog, No. 160, introduces the line of general purpose valves manufactured for industry by Madden Brass Products Co., Aurora, Ill. It also describes a wide range of other industrial products, including flare fittings, drain cocks, tube working tools, brass pipe fittings.

Circle **Item 18** on Inquiry Card

Heating and Ventilating Units

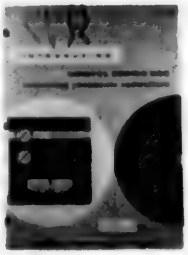
A 24-page catalog describing its Seasonvent heating and ventilating units is published by McQuay, Inc., Minneapolis, Minn. Catalog 575 gives detailed information on sizes, capacities, accessories and applications, and includes a comprehensive selection data section containing charts, tables.

Circle **Item 19** on Inquiry Card

Motor Selector

An 8-page guide to motor selection is announced by Howell Electric Motors Co., Howell, Mich. It lists in easy-to-use arrangement a quick reference to the complete motor and generator lines available through the consolidation of Howell with three other manufacturing companies.

Circle **Item 20** on Inquiry Card



Indicating Pneumatic Controllers

The Bristol Co., Waterbury, Conn., offers a 6-page bulletin (DM058) describing its new Series 624 indicating pneumatic controllers, with the A/D control unit featured. Specifications are given, and models are listed for controlling pressure, vacuum, liquid level, flow, temperature.

Circle **Item 21** on Inquiry Card

Valves

Publication of a 4-page bulletin is announced by White Flomatic Div., Flomatic Corp., Hoosick Falls, N. Y. It illustrates and describes the company's full line of foot valves, line check valves, union swing check valves, and union globe and angle valves.

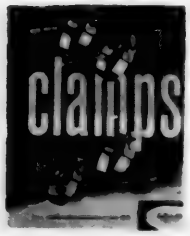
Circle **Item 22** on Inquiry Card

Industrial Hygiene

A 20-page brochure describing its services is available from Industrial Hygiene Foundation, Mellon Institute, Pittsburgh, Pa. The Foundation was established by industry in 1935 as a centralized research organization to provide services such as environmental surveys and air pollution studies.

Circle **Item 23** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.



Plastic Pipe Clamps

A 4-page catalog, published by Ideal Corp., Brooklyn, N. Y., offers extensive information on the company's lines of clamps for plastic pipe, hose, and varied industrial applications. Catalog 1-103 provides illustrations, construction details, specific recommended uses.

Circle **Item 24** on Inquiry Card

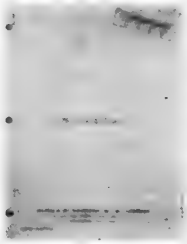
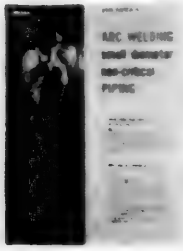


Plate-Type Diffusers

Anemostat Corp. of America, New York, N. Y., offers 4-page Catalog DAP-70 describing its Diffus-A-Plate Type DP plate-type diffuser. Used as separate units or in continuous sections, it is suitable for heating, ventilating and cooling when installed in the sill or in the floor.

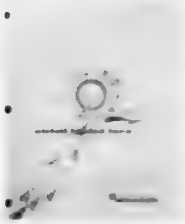
Circle **Item 25** on Inquiry Card



Arc Welding of Small Pipe

Basic information concerning arc welding techniques for small diameter (6 inches and under) non-critical piping is contained in a 4-page bulletin (2112.3) published by The Lincoln Electric Co., Cleveland, Ohio. Bulletin tells how to make the weld, how to figure welding costs.

Circle **Item 26** on Inquiry Card



Airfoil Bladed Fans

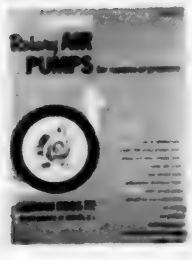
A 60-page bulletin (No. A-1103) describing new Series 116 centrifugal-type airfoil bladed fans is available from American-Standard Industrial Div., Detroit, Mich. It lists suggested applications, and contains 30 pages of capacity tables for standard air conditions.

Circle **Item 27** on Inquiry Card

Standard Blowers

Comprehensive selection data, including capacity tables and specifications, constitute most of 28-page Catalog STD-60 on standard blowers available from Airfan Engineering Co., Los Angeles, Calif. Included are 4-way discharge units, twin and triple assemblies, utility sets, etc.

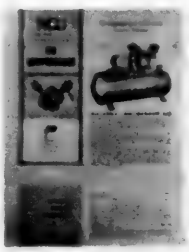
Circle **Item 28** on Inquiry Card



Rotary Air Pumps

Rotary positive air pumps for vacuum or pressure are manufactured by Leiman Bros., Inc., Newark, N. J., and are described in 32-page Catalog 460. It contains details of construction, dimensions, capacities, performance curves on all pumps, and comprehensive engineering data.

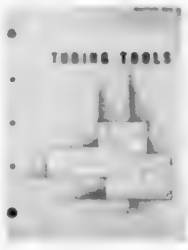
Circle **Item 29** on Inquiry Card



Air Compressors

Reciprocating, carbon-ring air compressors, which deliver oil-free, low-temperature air at maximum volume per kilowatt-hour for hospital and laboratory central systems, are described in a 4-page booklet which is offered by National Cylinder Gas Div., Chemetron Corp., Chicago, Ill.

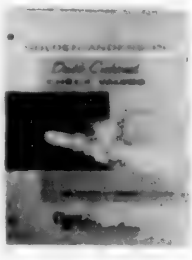
Circle **Item 30** on Inquiry Card



Tubing Tools

A complete line of tubing tools is described in a 32-page catalog by The Imperial Brass Mfg. Co., Chicago, Ill. Catalog No. 3121 shows over 75 tools and kits for all tubing work, including cutting, flaring, bending, reaming, swaging and refacing. It also describes service aids such as test caps.

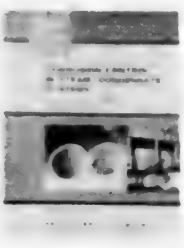
Circle **Item 31** on Inquiry Card



Double Cushioned Check Valves

A 4-page bulletin, WS-1A, offered by Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., describes G-A double cushioned check valves for boiler feed lines, steam pumps, compressors and reciprocating pumps. Valves prevent damaging hammer and shock due to back surge.

Circle **Item 32** on Inquiry Card



Corrosion Control for Condensate

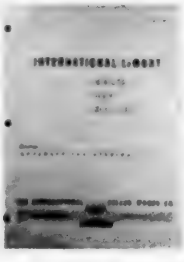
Corrosion control methods used in steam-condensate systems are described in a 4-page bulletin available from Nalco Chemical Co., Chicago, Ill. It covers use of filming corrosion inhibitors and neutralizing amines for medium to high makeup systems and for low makeup systems, respectively.

Circle **Item 33** on Inquiry Card

Steam Traps

A 4-page bulletin, published by Sterling, Inc., Milwaukee, Wis., describes the Sterlco lines of thermostatic radiator traps, and float and thermostatic traps. Roughing-in dimensions and capacity tables are shown for all models. Ratings comply with industry standards.

Circle **Item 34** on Inquiry Card



Waste Heat Boilers

Waste heat boilers are described in 4-page Bulletin 1700 by The International Boiler Works Co., East Stroudsburg, Pa. This specialized line of International-LaMont forced recirculation generators is designed to make use of waste heat from industrial and process heat sources.

Circle **Item 35** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Tubing Selection Guide

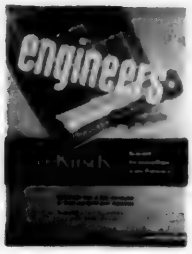
The selection of steel tubing according to type, finish, analysis, formability, weldability and relative cost is facilitated by comparative listing of characteristics of seamless and welded tubing in Bulletin 12-10, published by Joseph T. Ryerson & Son, Inc., Chicago, Ill.

Circle **Item 36** on Inquiry Card

Check Valve Performance

Pressure loss tests for Williams-Hager Silent check valves is the subject of a 4-page bulletin (659) available from The Williams Gauge Co., Inc., Pittsburgh, Pa. Tests, which were university-conducted, analyze pressure losses for globe type valves ranging from 4 through 18 inches.

Circle **Item 37** on Inquiry Card



Steel Fin Condensers

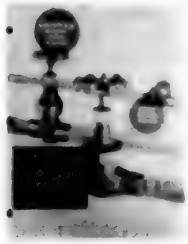
A 16-page catalog which illustrates and describes the company's custom and standard steel fin condensers for static and forced draft applications is announced by Refrigeration Div., Kirsch Co., Sturgis, Mich. Custom condensers can be assembled to meet exact heat transfer requirements.

Circle **Item 38** on Inquiry Card

Ultra Clean Facility Requirements

Requirements for an ultra clean facility are discussed in brochure published by Environmental Div., Shielding, Inc., Riverton, N. J. Under main headings *construction* and *environmental control systems*, the following topics are covered: Illumination, air-showers, temperature-humidity, etc.

Circle **Item 39** on Inquiry Card



Bronze Solder Joint Valves

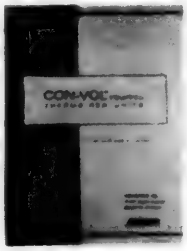
A revised edition of the company's bulletin describing bronze solder joint valves is announced by Walworth Co., New York, N. Y. Major change is inclusion of No. 2SJ bronze gate valve. A retained feature is an illustrated section, How to make a sound solder joint.

Circle **Item 40** on Inquiry Card

Underground Sprinkler Systems

How to plan, layout and install a Rain Jet underground sprinkler system is the theme of a brochure available from Rain Jet Corp., Burbank, Calif. A scaled graph sheet and engineering data are included, together with templates showing the coverage of the company's sprinkler heads.

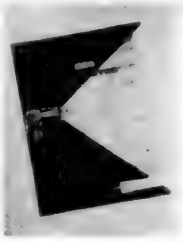
Circle **Item 41** on Inquiry Card



High Velocity Air Distribution

Thermotank Inc., Detroit, Mich., is the publisher of a 20-page catalog on the control and distribution of high velocity air. Included in catalog is product information and performance data covering perimeter and ceiling units, mixing boxes, cooling and heating cycles, constant volume control.

Circle **Item 42** on Inquiry Card



Electric Eyes

Photomation, Inc., Bergenfield, N. J., offers a 6-page booklet containing information about developments in the design and application of Ess electric eyes. Measuring instruments utilizing electric eyes include the company's Smokgage, Hazegage, Turbidigage, and various recorders.

Circle **Item 43** on Inquiry Card

Acoustical Products

Certified pressure drop and sound attenuation data for Uni-Silencers, airflow silencers specifically designed for air conditioning systems, are tabulated in 8-page Catalog No. 160, available from Elof Hansson, Inc., New York, N. Y. Manufacturer guarantees acoustical performance.

Circle **Item 44** on Inquiry Card

Plastic Drain and Sewer Fittings

Information on plastic drain and sewer fittings is available from Sloane Mfg. Co., Sun Valley, Calif. The 6-page bulletin includes photos of each type of fitting, details five easy steps of installation, and also includes general application data and fitting specifications.

Circle **Item 45** on Inquiry Card

Electrostatic Air Filters

Stoddard Industries, Inc., Cudahy, Wis., announces a 4-page bulletin giving complete information on its electrostatic Dust-Magnet filters and the filter material called Poly-Mag 80. Technical data include filter maintenance and cleaning tips, recommended specifications, and performance data.

Circle **Item 46** on Inquiry Card

Tank Heaters

A 16-page guide to specifying water heaters for heating with either steam or hot water is offered by Bell & Gossett Co., Morton Grove, Ill. It tells how to determine the exact kind of heating unit needed to meet various water temperature and volume requirements.

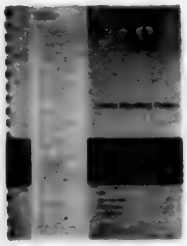
Circle **Item 47** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Pressure Atomizing Oil Burner

Type C-45 pressure atomizing oil burner is listed by Underwriters Laboratories for use with economical, heavy commercial No. 4 and No. 5 fuel oils. Manufactured by National Airoil Burner Co., Inc., Philadelphia, Pa., this burner is described in 4-page Bulletin 100.

Circle **Item 48** on Inquiry Card



Waste Handling Pumps

Eleven different types of pumping equipment for handling waste materials in all forms (liquids, slurries, gases and solids) are described in 4-page Bulletin 2305 by Yeomans Brothers Co., Melrose Park, Ill. Included is a selection guide which matches pump to waste material.

Circle **Item 49** on Inquiry Card

Building Maintenance Manual

Detailed information on the general maintenance of interior areas of commercial, industrial, institutional and public buildings is provided in a new, 28-page building maintenance manual. It is published by Service Products Div., Johnson's Wax, Racine, Wis. Care of floors is emphasized.

Circle **Item 50** on Inquiry Card

Electric Check Valve

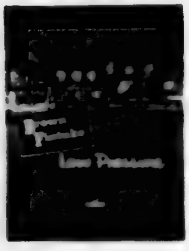
Electric Double-Cushioned check valve described here by Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., does not open until the pump comes up to speed. Closing of the valve begins while pump is still operating. When valve is 95% closed, pump is automatically shut down.

Circle **Item 51** on Inquiry Card

Thermal Insulation

Complete thermal and acoustical characteristics of Fine-Fyber Felt insulation are presented in a 4-page bulletin (J-66) from Baldwin-Ehret-Hill, Inc., Trenton, N. J. A table lists and describes the various factory-applied facings and coatings available for the insulation.

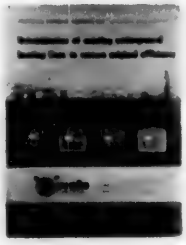
Circle **Item 52** on Inquiry Card



Double Pipe Heat Exchangers

The new 3-inch low-pressure double-pipe heat exchangers recently developed by Brown Fintube Co., Elyria, Ohio, are described in 8-page Bulletin 110. Salient features and advantages of this design are discussed, and cutaways, drawings, specifications and tables of dimensions are included.

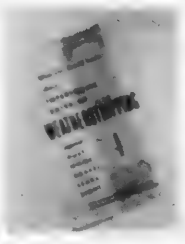
Circle **Item 53** on Inquiry Card



Underground Heating Lines

Proven methods for use of "Z"crete brand customized systems of insulating concrete conduit in the rehabilitation of existing underground heating lines to restore their original efficiency are described in a 4-page brochure offered by Concrete Thermal Casings, Inc., Seattle, Wash.

Circle **Item 54** on Inquiry Card



Interior, Exterior Weatherstripping

The principles of interior and exterior weatherstripping against dust, noise, drafts, leaks and light are covered in an informative, 16-page booklet published by Pemko Mfg. Co., Emeryville, Calif. Emphasis is placed upon the weatherstripping of industrial and commercial buildings.

Circle **Item 55** on Inquiry Card

Tube Fittings

A comprehensive, 118-page catalog of original equipment and replacement tube fittings is announced by The Lenz Co., Dayton, Ohio. A feature of the catalog is a completely illustrated index for quick reference to each fitting. Each specification table is keyed to a large drawing.

Circle **Item 56** on Inquiry Card

Industrial Hot Water Boilers

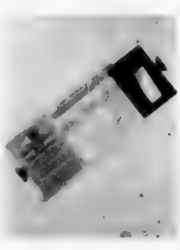
Designed specifically for closed circuit applications wherever large volumes of hot water are required, industrial hot water boilers are available from Sid E. Parker Boiler Mfg. Co., Los Angeles, Calif., in sizes ranging from 126,000 to 5,000,000 Btu per hr input. Bulletin gives details.

Circle **Item 57** on Inquiry Card

Residential Ventilation

A 4-page bulletin (A-114) describing the Ventura line of attic fans for residential ventilation is available from American-Standard Industrial Div., Detroit, Mich. Capacities for the various Model CA and Model CAV fan sizes available are tabulated along with fan speed, motor hp, etc.

Circle **Item 58** on Inquiry Card



Gas Vent Calculator

A Gas Vent Calculator, developed by Metalbestos Div., William Wallace Co., Belmont, Calif., gives correct gas vent pipe sizes in seconds for any gas-fired appliance installation. All user has to know is rated input of appliance, the lengths of runs and number of connectors. Request Calculator from your Metalbestos distributor.

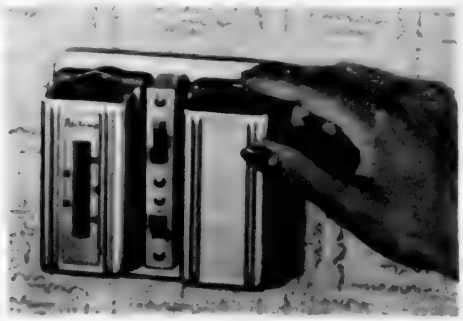
NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

Effective Temperature Controller

Airtemp Div., Chrysler Corp., Dayton, Ohio, has developed a device, called an Effective Temperature Controller, which automatically compensates for humidity rise by lowering the dry bulb temperature. Chrysler air conditioning units will offer this controller which combines a thermostat and humidistat.

The humidistat registers any humidity rise and



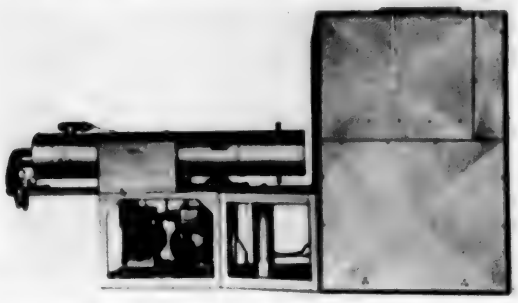
closes a circuit to the thermostat which contains an auxiliary heater. The heater, comprised of a small resistor, adds artificial heat in the vicinity of the thermostat's bi-metal sensing element.

This causes the thermostat to begin compressor operation as if the thermostat setting were two or three degrees below the ambient air temperature. If the thermostat is set to hold 78 deg F in the space and the humidity rises, the humidistat will cause the control point of the thermostat to drop to approximately 76 deg.

More information? Circle Item 59, postcard, last page.

Six Packaged Liquid Chillers

Packaged liquid chillers in 8, 10, 15, 20, 25, and 30 ton units are announced by Crane Co., Chicago, Ill.



Equipped for operation with three types of condensers, water cooled, evaporative and air cooled, they are designed for use in any chilled liquid system.

Each unit is factory engineered, assembled and test-operated to provide a perfectly balanced refrigeration system, the company states. They are easily installed and require only piping and power connections for immediate use.

Typical applications include temperature control in electroplating tanks, cooling of cutting and quenching oils, and cooling of injection molding machines.

More information? Circle Item 60, postcard, last page.

New Gas Water Heater

Development of a new type of gas water heater that is reported to deliver 127% more hot water per hour than ordinary units of the same size is announced by The Hotstream Heater Co., Cleveland, Ohio.

Utilizing new concepts in design and construction, this heater, a 40-gal automatic storage type called the Hotstream J-40, has a recovery rate of over one gallon

per minute raised 100 deg F and is suitable for both home and commercial applications. With an input rating of 75,000 Btu per hr, it has a capacity comparable to the storage and recovery capacity of conventional 75-gal heaters, the company announces.

This break-through in existing limitations on recovery capacity is made possible through utilization of a new concept in flue construction. The J-40 is designed with an internal-external flue system that provides exposure of a heat transfer surface area 460% greater than that of widely used internal flue heaters, and 13% greater than external flue heaters.

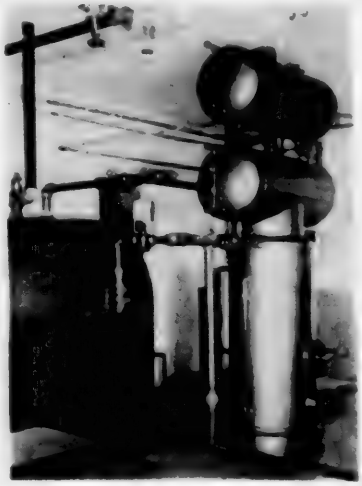
This design not only increases the heater's recovery but also reduces the problem of "stacking"—the build-up of abnormally high temperatures at the top of the tank when repeated short draws of water keep the burner on.

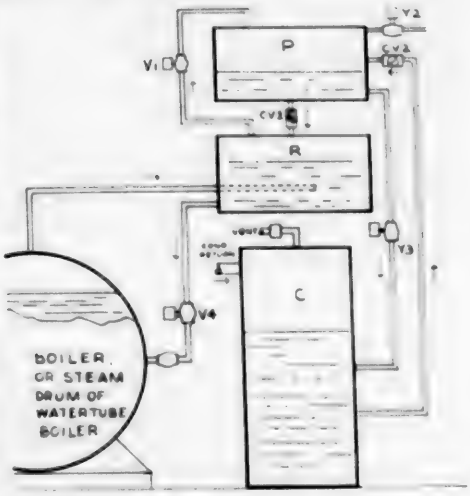
Tested and approved for safe operation, durable construction and performance by the American Gas Association, the J-40 can be installed on combustible floors and as close as two inches to combustible walls.

More information? Circle Item 61, postcard, last page.

Condensate Return System Eliminates Flash Loss

Complete elimination of condensate flash loss, which in the case of high pressure processes can amount to 15% of the feedwater requirement, is reported to be an outstanding feature of the H T Boiler Feeder built by the H T Boiler Feeder Co., Phoenixville, Pa. In addition, the preheating of makeup and condensate in the specially designed reservoir tank deaerates the boiler feedwater to well below the 0.03 cc per liter standard required to control oxygen corrosion of boiler surfaces.





Basically, the H T Boiler Feeder, as shown in photo, is a gravity flow system with none of the troublesome and costly disadvantages of conventional pump-type feedwater systems, according to the company.

At far right is a schematic diagram of the system feeding a conventional boiler. Condensate Tank C receives makeup water from fresh water supply, and condensate from heating or process steam lines. This tank may be vented to atmosphere; or it may be closed to permit return of condensate at high temperatures. In the latter case, the tank could be equipped with an air venting steam trap. Pressure in the tank will vary with condensate temperature; for example, condensate returning at 300 deg F would require about 50 psig in tank. With this closed condensate arrangement, flash losses are avoided.

Feeding water to the boiler is brought about by alternately producing vacuum and pressure in Tank P. With vacuum in this tank (or pressure lower than that in Tank C), water will flow from condensate tank through suction pipe and check valve CV2 to fill Tank P. When water has reached desired level in Tank P, a water level control will operate to open valve V1 on pipe connecting Tanks P and R. This will permit steam condensate in Tank R to flow from Tank R to Tank P, equalizing pressures and causing gravity flow of water from Tank P to Tank R. Reserve Tank R which provides a reservoir of feedwater for the boiler, is supplied continuously with steam from the boiler through a mixing device such as a perforated tube.

Equalized pressure allows water to flow by gravity to the boiler from Tank R which is located above the water level of the boiler. A conventional water level control for the boiler may be employed; such a control may, for example, operate a valve V4 to maintain normal level.

When pump tank, P, has been completely emptied, the water level control connected to Tank P will operate to close steam valve V1 and open valves V2 and V3, and check valve CV1 will close. Opening of valve V3 allows exhaust of steam and air from Tank P into Tank C where steam may be condensed and air be vented to atmosphere. Pressure in Tank P will now drop to that of Tank C. Opening of valve V2 introduces a flow of cooling water into Tank P, condensing remainder of steam and causing pressure to fall below pressure in Tank C. Water will again flow from Tank C to fill Tank P. This operating cycle will repeat automatically each time the boilerfeed tank, P, is emptied.

Reservoir Tank R contains feedwater at all times that is heated continuously by steam to near boiler pressures, assuring a constant supply of feedwater to the boiler. Being heated continuously by steam, scale-forming mineral matter in the make-up water precipitates in this tank and can be blown off and removed before entering the boiler. Air and carbon dioxide leave this heated feedwater when steam valve to Tank P opens and causes momentary pressure drop and flashing in Tank R.

More information? Circle Item 62, postcard, last page.

Teflon Rings in Steel Valves

Walworth Co., New York, N.Y., announces the availability of Teflon-inserted seat rings as optional equipment for its 150-300 lb bolted bonnet steel valves in sizes from 2 through 10 inches.

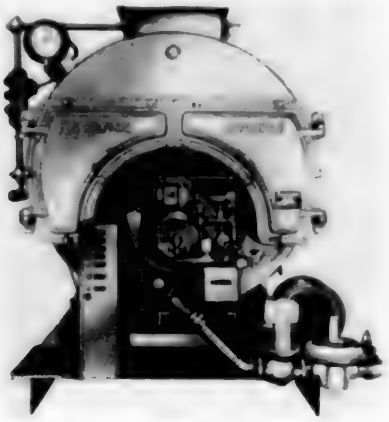
These valves are often used in refineries or on refined products, as lubricating oils, kerosene and aviation fuels, where an absolutely tight seal is imperative. The resilient Teflon is substituted for one of the metal seating surfaces of the valve giving a tighter closure than is possible with a metal-to-metal seal. Teflon is a DuPont plastic material having a low coefficient of friction, and is almost completely inert to chemical attack.

More information? Circle Item 63, postcard, last page.

Versatile Boiler Line

A line of Kewanee Scotch type packaged commercial boilers for high- and low-pressure operation with forced-draft firing is available from American-Standard Industrial Division, Detroit, Mich.

Certified output ratings are 83-691 hp for the low pressure units, 82-672 hp for the high pressure units. Ratings are based on 5 sq ft of ASME (fireside) heating surface per boiler horsepower. The low pressure packages are constructed in accordance with the ASME



code for 15 psi steam or 30 psi water, the high pressure packages for 125 or 150 psi steam. Higher pressures are available on special order.

Forced-draft burners fire natural gas, all grades of fuel oil or combination gas-oil. Adjustable variable-vaned air nozzle readily permits shaping of the oil flame with the varying grades of fuel oil found in different areas. Integral burners and controls are factory mounted and fire tested before shipment. Each entire boiler package is listed by Underwriters Laboratories, Inc. Packages are factory-assembled, on skids, with only service connections required for installation.

Highest heat release in any of the low-pressure packaged units is 66,660 Btu per hr cu ft. In high-pressure units it is 64,620. This is said to assure quieter operation and longer operating life. Also, because of low heat releases, it is not necessary to weld any tube ends. All tube ends are roller expanded and beaded for both low and high pressure.

Boilers have hinged cast iron flue doors with quick-release clamps for simplified cleaning. Controls are contained in a front-mounted dust-proof, heavy gage steel cabinet. In addition to conventional safety controls, an air-flow safety switch delays firing until the forced-draft blower is operating at the correct speed. The electric oil preheater has a cast aluminum multi-pass reservoir with immersed thermostatic control.

More information? Circle Item 64, postcard, last page.

Computer Service Announced

A computer service that produces a piping flexibility analysis within forty-eight hours is available from The Service Bureau Corp., New York, N.Y., a nation-wide subsidiary of IBM. If needed, an analysis can be provided within a few hours.

Here is how the service works: Clients prepare a simple description of their piping system on data sheets that are sent to SBC. SBC punches the information into IBM cards and processes it on an IBM 704 computer. This cycle normally takes twelve hours, but can be stepped up if necessary.

Reports include anchor and restraint reactions; forces, moments and stresses at all intermediate points as well as displacements and rotations. Tangents, bends and closed loops in any combination having any orientation are permissible. Changes to a system are easily specified since coordinates are not used in the input data.

According to SBC, flexibility and stress intensification factors are automatically introduced by the program.

More information? Circle Item 65, postcard, last page.

Low-Boy Fan-Coil Units

A low-silhouette fan-coil air conditioner is designed by Modine Mfg. Co., Racine, Wis., for multi-story buildings with floor-level fenestration or low windows. Called the Low-Boy Airditioner, it is only 14½ inches high, about half the height of standard fan-coil units, the company states.

The new, low size enables the unit to be located at the center of the window base, blanketing the window exposure. The fan-coil unit has two small-diameter pipes and a condensate drain. It is fed hot or chilled water from a central source. Pipes, condensate drain and electrical service lines are all located above the floor and generally are concealed by enclosing them within an inexpensive metal cover or chase.

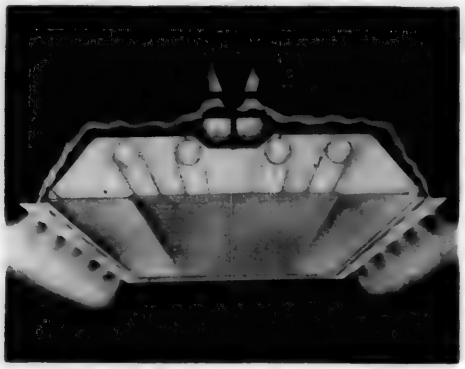
Installed free standing on the floor, a few inches in from the wall, unit provides ample clearance for drapes. Because it utilizes only simple piping, ducting, with subsequent floor build-up, is eliminated, cutting costs. According to the manufacturer, occupants have maximum control over cooling and heating performance, air delivery, and noise level.

Four standard units are available, ranging in length from 44 to 96 inches in a range of capacities from 200 to 600 cfm and from 14,300 to 44,900 Btu per hr.

More information? Circle Item 66, postcard, last page.

Light and Air Diffusing Equipment

Day-Brite Lighting, Inc., St. Louis, Mo., and Barber-Colman Co., Rockford, Ill., announce a complete line of combination lighting and air diffusing equipment, developed through the combined research facilities of the two companies. The new units are described as "the successful blending of two prime comfort factors, which provide the much needed solution to a growing



problem in interior design . . . the competition between acoustical material, air distribution, and lighting elements."

The dual-purpose units are available in both 12 x 48 inch and 24 x 48 inch sizes, with a wide choice of lighting enclosures including louvers, plastic and glass.

Combination diffusers eliminate conflicting ceiling placement problems of lighting and air distribution elements. Regular Day-Brite Troffers and Mobilex units can be integrated with combination units in the same installation. This allows adaptation of lighting systems to changing space and task requirements. Supply and return air distribution elements are interchangeable in any location from the same unit. Combination diffusers have inconspicuous air distribution apertures. Operation leaves no ceiling or enclosure smudge. Unit retains full-width luminous area.

Double wall construction allows air to pass through separate chamber completely isolated from fluorescent lamps. Light output, lamp life, and color are not affected. Adequate duct size, 5-inch dia., permits higher volume of conditioned air at lower velocity and lower noise levels.

More information? Circle Item 67, postcard, last page.

Double-Width Scaffold

A new steel scaffold, the Model K, offering increased work platform area is being introduced for general use by Baker-Roos, Inc., Indianapolis, Ind. It is designed for work at greater heights, and uses many components of the standard Baker scaffold.

End frames are welded assemblies, part of which is a built-in ladder for access to the platform area. A stairway is offered as optional equipment. It locks into position on the inside of the scaffold unit and provides easy access to platform levels. Platforms and platform support trusses of the standard scaffold may be used with the Model K.

Height of the single unit is 6 ft. Additional heights may be reached easily by stacking. Supplemental stabilizing is available when needed.

More information? Circle Item 68, postcard, last page.

Glass-Protected Smokestacks

Availability of glass-protected smokestacks in a wide variety of custom colors is announced by Process Equipment Div., A. O. Smith Corp., Milwaukee, Wis.

The steel smokestack, lined inside and out with richly colored acid-resistant glass, is said to increase the stack life three to five times. Considering beauty

alone, it more effectively dresses up a smoke stack than the long-standing practice of painting and repainting metal, for two reasons; extreme temperature and weather conditions have little or no dulling effect on the shiny, colored glass; and corrosion cannot be hidden under a layer of paint.

More information? Circle Item 69, postcard, last page.

Fiber Pipe Fittings

A new line of 4-inch fiber pipe fittings is announced by Kyova Fiber Pipe Co., Ironton, Ohio. According to the manufacturer, its special composition lends these fittings high impact strength, and tests have shown

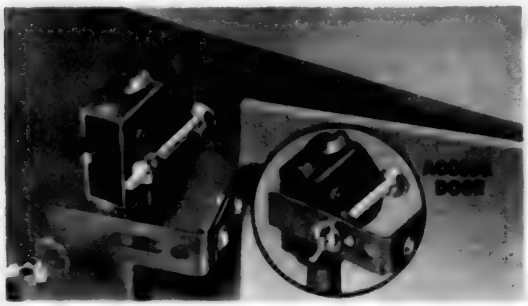
them to be shatter-proof, root-proof, and exceptionally durable; also, that, reinforced with fiber glass, their texture assures a tight, waterproof joint and fast, simple installation. Fittings are available in ⅛ bends, ¼ bends, wyes and tees.

More information? Circle Item 70, postcard, last page.

Safety Door Switch

A safety switch, for use on access doors leading to plenums in air conditioning systems or other chambers where there is a possibility of shock hazard to service personnel, has been developed by CRS Industries, Philadelphia, Pa.

Its first safety feature is that before the access door can be opened a wing nut must be manually unscrewed. This unlocking operation immediately in-



terrupts the primary power from the generator, thus preventing a resumption of power should the door blow closed after a man has entered the chamber. A second safety feature is that the switch cannot be locked ON with the access door open, thus requiring a second man at the switch if high voltage equipment is to be checked.

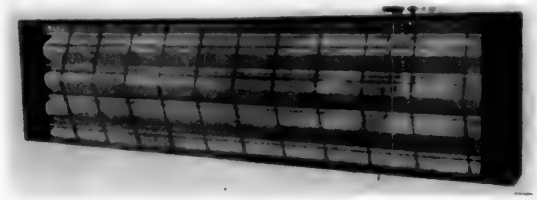
The safety switch, Model S911, which bears UL and CSA labels, permits full flexibility of location and position on either left or right hand door openings, and has SPST normally-open contacts rated at 15 amps, 125 volts a-c.

More information? Circle Item 71, postcard, last page.

Electric Radiant Heat Panel

An electric radiant heat panel for commercial and industrial applications, Chromalox Type QRP, is announced by Infrared Div., Edwin L. Wiegand Co., Pittsburgh, Pa. Panels are equipped with quartz tube elements.

The series is designed to provide excellent terminal



and resistor life and to obtain maximum serviceability from the quartz heat source, the company states. Uses for the panels include: paint baking, industrial process heating, railroad car thawing, marquee heating, and indoor and outdoor spot comfort heating.

Dimensions are 1 x 4 ft. Four and six kilowatt panels are available for 208 and 240 volts, while the 240 volt elements may be connected in series for operation on 480 volts.

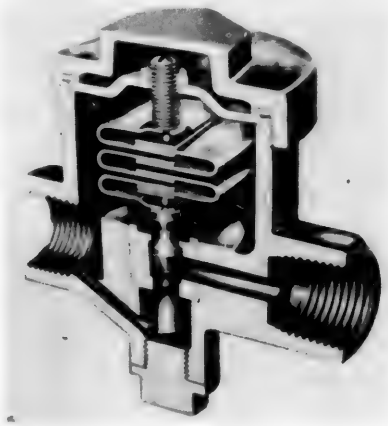
Where large areas of radiation are involved, panels may be mounted horizontally, at any angle, end to end, and edge to edge on ½-inch conduit stems. Also on metal framework using ¼-inch bolts for which spot-weld nuts are provided on the back of each panel. Single-end wiring by user is facilitated by built-in wiring gutter.

More information? Circle Item 72, postcard, last page.

Thermostatic Steam Traps

A line of thermostatic steam traps available from MIL Div., Farris Engineering Corp., Palisades Park, N.J., includes high and low pressure types in pressure-balanced thermostatic and float-thermostatic designs.

Traps are unaffected by pressure, water hammer, frost, corrosion, or rough handling, the company says.



Operation is maintained by indestructible, stainless steel, bimetal thermal element with universal joints. The thermal element responds only to temperature. According to the manufacturer, it has proved more reliable than bellows and diaphragms.

Maximum resistance to corrosion and metal fatigue is accomplished by use of forged, aluminum-bronze for the bodies, and stainless steel for all working parts. Applications include superheat service to 500 deg F.

More information? Circle Item 73, postcard, last page.

Flame-Resistant Duct Tape

An extremely flame-resistant cloth adhesive tape for heating duct work connections and insulation taping is being produced by Arno Adhesive Tapes, Inc., Michigan City, Ind.

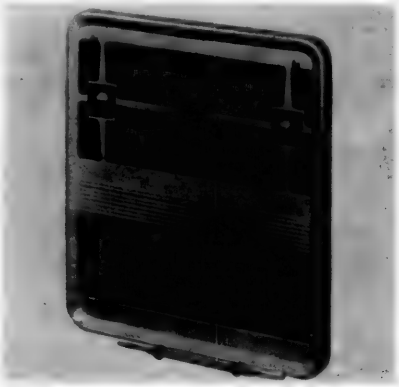
Known as C-506 Flame Resistant Ductape, it is made of specially treated and coated cloth, in tan and aluminum colors, with a high-tack, low-creep adhesive that is rubber-based and pressure sensitive.

The tape meets the requirements of ASTM Specification D-626 on fire-resistant fabrics. The thermo-setting nature of the adhesive makes it ideal for duct-work taping, the company reports, since normal heats will not loosen or soften it.

More information? Circle Item 74, postcard, last page.

Fan-Forced Electric Heaters

Series H260 heavy-duty, fan-forced electric wall heaters, called Heetaires, are announced by Markel



Electric Products, Inc., and LaSalle Products, Inc., Buffalo, N.Y. Both utility and style are featured, according to the companies.

Units are available in capacities from 2,000 to 4,800 watts (6800 to 16,400 Btu per hr) for either 240- or 208-volt operation.

They are designed for permanent or occasional heat, and best suited for those areas where quiet operation is essential (8-inch blade turns at only 700 rpm), harmonious style is important, and where good heat distribution over large areas, and fast temperature recovery are desirable.

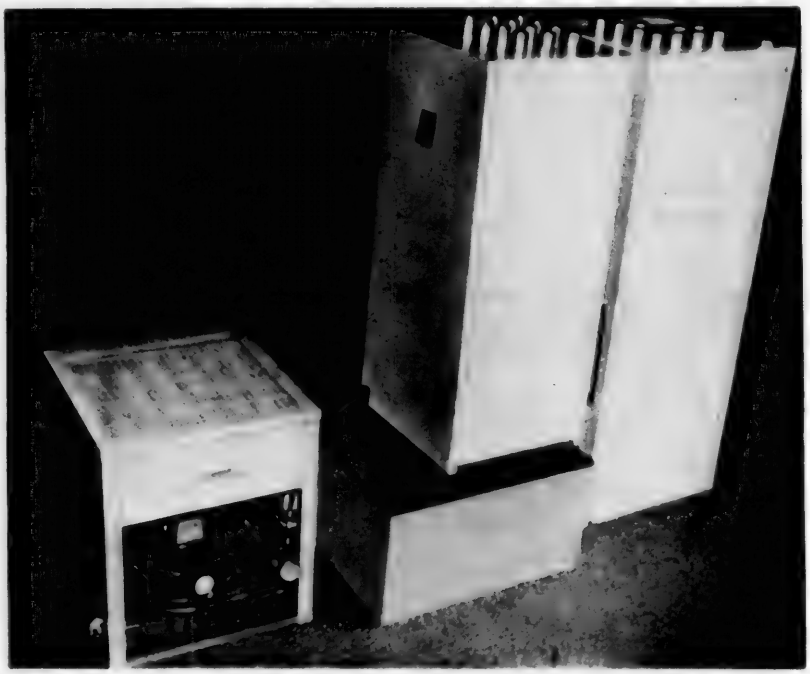
Front case is finished in high gloss beige enamel (which may be repainted to match walls) and satin finish aluminum decorative louvers. Two types are available: one for recessed mounting in standard 2 x 4 on 16-inch center frame walls, and the other for surface mounting on masonry construction.

Heaters are equipped with an automatic reset safety switch which disconnects elements and motor if air flow is obstructed. Lifetime sealed, totally enclosed resilient mounted motor is said to assure long life and quiet operation. Built-in automatic thermostat control and separate on-off switch are included as standard equipment.

More information? Circle Item 75, postcard, last page.

High-Velocity, Flexible-Duct Cooling System for Homes

A residential central cooling system, called Jet-Cool, drastically reduces the cost of central cooling installation, according to its manufacturer, Jet-Heet, Inc., Englewood, N.J. The system substitutes two-inch flexible tubes for conventional sheet metal ductwork, delivering colder air at higher velocities.



These Jet-Tubes are strung through existing stud spaces like BX cable and can be installed by two men in one day, the company says. Insulated and vapor-tight, the tubes are the same as those used with the company's Jet-Heet heating system.

In order to deliver sufficient cooling and dehumidification through these small tubes, the system's evaporator section delivers air at four times the conventional velocity and at lower temperature. Air, cooled to 40 deg F dry bulb, 40 deg F wet bulb, is delivered to special aspirating registers which blend supply and room air. The 40-deg dew point air is virtually moisture-free. Mixture of high velocity air with room air at registers is said to result in better distribution of air, bringing to the homeowner, for the first time, the advantages of the high velocity system used for years in hotels and other commercial establishments.

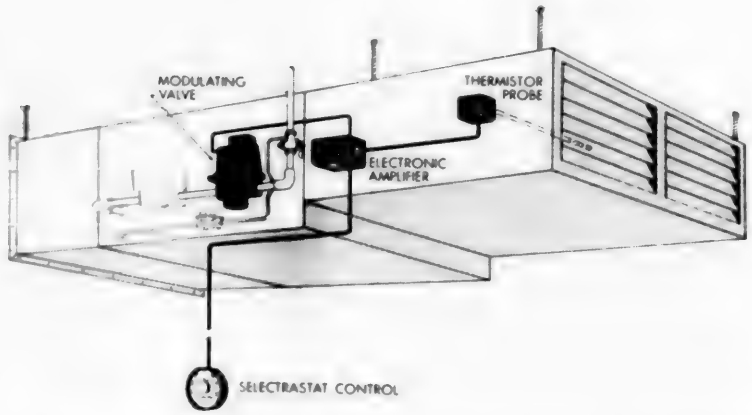
The system has its own blower, sized for cooling service, which can be used in parallel with, or completely without a central furnace. Air cooled condensing unit is set outside the house. Installation can be made in any one of three ways: (1) separately, in homes with adequate steam, hot water, or electric heat; (2) as an add-on to the company's Jet-Heet (high velocity heating) system; and (3) as an add-on to a conventional warm air heating system. System is competitive in price with conventional systems, according to the manufacturer.

More information? Circle Item 76, postcard, last page.

Modulation Control for Make-up Air Systems

An electronic modulation system for gas fired duct heaters used in make-up air systems is announced by Maxitrol Co., Detroit, Mich. The system is reported to eliminate many of the problems of make-up air introduction into public halls, theaters, restaurants, etc.

Generally, make-up air is introduced at about two degrees below the comfort setting. A major problem with make-up air installations has been the inflexibility of fixed input heaters. There is a tendency to overheat in mild weather. Attempts have been made to meet this problem by cutting in and out a series of separate burners or by complicated baffling. Modulation, where used, has employed the mechanical bulb and bellows element. A need has existed for a truly sensitive modulating system, with instantaneous response and remote control.



The Maxitrol make-up air modulation control features a small probe which is inserted in the warm air duct between the heat exchanger and the discharge head. The temperature-setting control, called a Selectrastat, may be located at any remote spot up to several hundred feet away from the heater. Contained in the probe is a tiny thermistor which can sense 1 10 degree temperature variations.

Signals from the probe thermistor are electronically amplified to energize a solenoid coil in the power head of the modulating valve. Valve action causes pressure changes which alter the gas burner input and thus change the combustion rate to hold the duct temperature constant. Modulation is infinitely variable from full fire to ⅓ fire. Capacity rating is 310,000 Btu per hr. The probe, ¼-inch dia by 9⅛ inches long, terminates in a small junction box. Mounting is accomplished by drilling a hole to insert the probe in the duct, and by attaching the junction box with three sheet metal screws.

More information? Circle Item 77, postcard, last page.

Zones Without Limit

There is essentially no practical limitation to the number of areas which can be monitored in a single installation with its Type Z temperature monitor system, according to Royco Instruments, Inc., Mountain View, Calif.

Designed to provide centralized observation of ambient temperatures in a multiplicity of areas operated by a single organization, the system is said to offer

particular advantages for refrigerated and air conditioned buildings, especially low-temperature food storage facilities.

Temperature capabilities range from minus 50 to plus 300 deg F. Selector switches on the main panel provide for calibration and for room selection, a confirming indicator light being mounted nearby. Temperatures appear directly on an indicating instrument and are accurate to ± 1% of scale reading.

Systems are designed for the simplest possible installation. Sensor probes of plug-terminated types are provided and mating extension cables permit runs to be made as long as 4,000 ft. Cables plug directly into the rear of the indicating panels. This arrangement permits the immediate replacement or comparison checking of sensor probes. The central power supply of the unit operates on 115-volt, 60-cycle power and draws 4 watts.

More information? Circle Item 78, postcard, last page.

Power Roof Ventilators

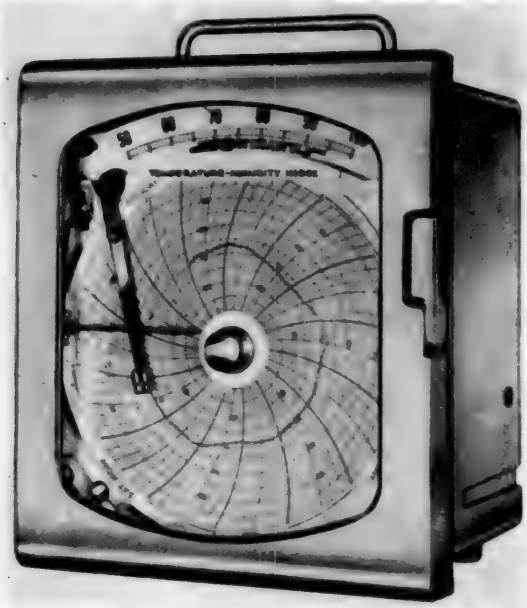
Four larger-size Model L-CRF power roof ventilators have been added to the line made by Ilg Electric Ventilating Co., Chicago, Ill. The new models range in capacities from 2720 to 27,290 cfm, in horsepower from ½ to 12, and by sound classifications from 1 to 7.

More information? Circle Item 79, postcard, last page.

Comfort Index Recorder

The Comfort Index Recorder, introduced by The Bristol Co., Waterbury, Conn., measures temperature and humidity and records the combined measurements as the Temperature-Humidity Index.

Recorder is a self contained, portable instrument.



Measuring elements are mounted in the case, and the chart is spring-driven.

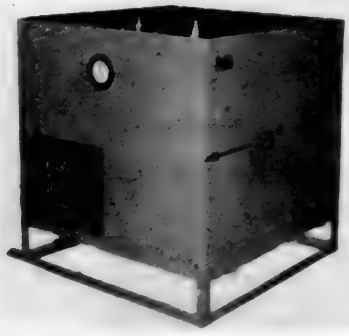
Two models are offered. One indicates the Temperature-Humidity Index and records both THI and ambient temperature; the other indicates and records THI only. Records are on a 6-inch dia, seven-day rotation chart.

Instrument is designed for use in determining air conditioning requirements and for service use in checking the function of present installations.

More information? Circle Item 80, postcard, last page.

Compact Air Dryer

Development of a compact air dryer, designated DHD-20, is announced by Special Products Div., Drayer-Hanson Division, Los Angeles, Calif. It is of special interest, the company states, to those industries employing pneumatic control.



Basic components are two cast aluminum heat exchangers, a drip leg, and centrifugal stripper. The 36-inch cube is of all-weld construction, its lines of copper or stainless.

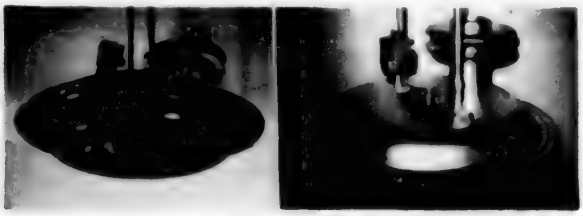
Dryer will automatically lower the dew point of a compressed air line to approximately 0 deg F with minimum pressure drop (less than 2½%). A small, hermetically sealed Freon compressor is the only moving part. Unit is designed to be used in ambients from 40 to 140 deg.

More information? Circle Item 81, postcard, last page.

Gas-Fired Radiant Heater

Quick, infra-red spot heat for a wide range of commercial, institutional, and industrial applications is obtained from a new gas-fired radiant heater offered by Solarflo Co., Glendora, Calif. It is AGA approved for vented as well as unvented application.

A circular burner head and pilot are enclosed above a saucer-shaped ceramic-coated metal radiating surface



over which a gas flame is projected horizontally. No fans, motors, or limit switches are employed. Photo at left shows the radiating surface, which carries a ten-year guarantee. A circular, internal baffle minimizes heat at the top and allows controls to be placed for most pleasing appearance, as shown in photo at right. All models have 100% safety controls and are operated by a 24-volt thermostat or wall switch. Units weigh 32 lb. Inputs range from 24,000 to 48,000 Btu per hr.

More information? Circle Item 82, postcard, last page.

Water Treatment for Towers

An automatic water treatment control system for cooling towers that regulates water treatment control and bleed-off feed in proportion to the rate of water evaporation, or to the cooling load of the system, is announced by Associated Laboratories, Inc., Lathrop Village, Mich. According to the Laboratories, the system, called Hydrotrol, offers fool-proof, fixed, accurate regulation without drift or waste of either chemicals or water.

Unit is available in all sizes for any size cooling tower, and is distributed by all member firms of Associated Laboratories.

More information? Circle Item 83, postcard, last page.

Packaged Gas-Fired Boiler

Series P packaged cast-iron, gas-fired boilers are offered by Hydrotherm, Inc., Northvale, N. J., in the 72,000 to 155,000 Btu per hr range.

According to the manufacturer, each is a quality heating plant which installs in minimum time and provides long, trouble-free, economical operation. Each of these factory assembled and wired units is equipped with a positive air elimination system which makes it possible to install a complete baseboard or convector system without use of air vents.

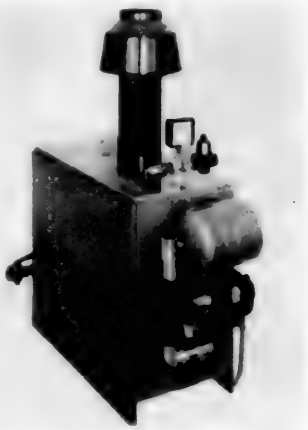


Photo shows all accessories assembled on rear of unit. Front panel is free of obstructions.

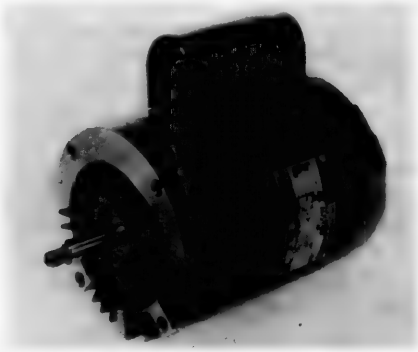
A Minneapolis-Honeywell power pile generates its own electricity for operation of the boiler control circuit, and in case of power failure assures partial heating through gravity circulation without manual operation of controls.

More information? Circle Item 84, postcard, last page.

Water Pump Motor

A "Jet Line" water pump motor in both 48- and 56-frame sizes is available from Westinghouse Electric Corp., Pittsburgh, Pa. It is designed to match all existing jet pump designs.

The 48-frame motors are available in ratings of ⅓ hp, 60 cycle, single phase or capacitor start; and ½ hp, 60 cycle, capacitor start. The 56-frame motors are in ratings of ¾, 1, 1½, and 2 hp with 3 phase, capacitor start. The speed at rated load is in excess of 3500 rpm.



All principal mounting dimensions of the motor, such as diameter of rabbet fit, bolt circle, and shaft size are in accord with recommended NEMA standards.

Electrical assemblies and mechanical parts of the motor are designed as individual units, physically independent of the other. Thus, end shields can be completely removed without disturbing the motor wires or connections.

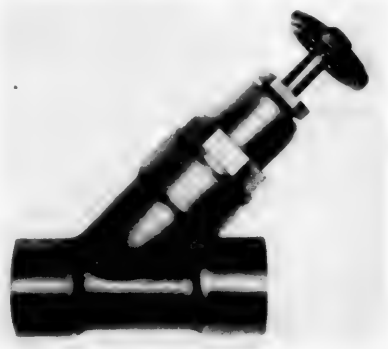
The permanently lubricated bearings are designed so that the motor can be operated either horizontally or vertically without grease leakage. Since the frame is one solid piece, there are no ventilating holes in the frame of the motors to permit dust and dirt contamination. Ventilating air is drawn through the motor—in the top and out the protected vents in the bottom end shield. This maintains a low temperature rise of the internal parts and lengthens the life of insulation and bearings.

More information? Circle Item 85, postcard, last page.

PVC Globe Valves

A line of PVC globe valves, announced by Dorak Products Corp., New York, N.Y., is furnished in a complete size range from ½ through 3 inches, with either screwed or socket-weld ends, and are rated for 125 psi service at 145 deg F.

The globe valves are molded of a non-plasticized polyvinyl chloride resin, which is said to result in the maximum chemical resistance and strength. These



valves are designed specifically for use in piping systems handling acids, alkalies, chemical salt solutions, pharmaceuticals, distilled water, as well as beverages and food products. In addition to chemical inertness, there is no resultant odor, flavor or taste imparted to the handled product.

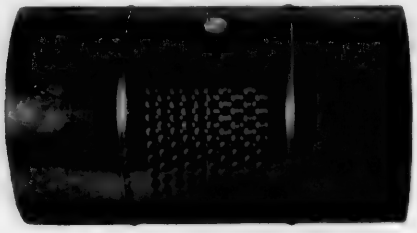
Light in weight and easy to handle, valves are said to have an unusually high strength-to-weight ratio. Internal surfaces are glass-like, as a result of injection molding, minimizing pressure drop and preventing deposits from forming. Readily installed outdoors, they are unaffected by weather and show no discoloration due to rust or other environmental corrosion.

Valves are designed with a particularly heavy diameter stem, utilizing strong Acme threads and thereby avoiding possible stem breakage. The stem is set at 45° to the pipe center-line, minimizing flow turbulence. In the fully open position, the valve back seats, allowing repacking under pressure.

More information? Circle Item 86, postcard, last page.

Round Duct Diffuser

A product which is described as a new concept in air distribution from round duct is announced by Spiral Pipe Div., United Sheet Metal Co., Inc., Columbus, Ohio. For use as an integral part of Spiral Lockseam round duct installations, the Duct-D-fuser has shaped nozzles formed in the wall in a planned pattern which provides complete selection of air volume, distribution and direction. The nozzles are reported to be scientifically designed to minimize noise level and air pressure drop.



Illustrated is Model F (fixed) Duct-D-fuser, with volume damper, which permits volume control without affecting diffusion angle. The basic direction of the air pattern is defined by the position of installation.

Also available are Model R (rotatable) and Type CP (custom pattern) Duct-D-fusers and Model S perforated pipe diffuser.

More information? Circle Item 87, postcard, last page.

Two Hermetic Heat Pumps

An hermetic heat pump, in two sizes, announced by Lennox Industries Inc., Marshalltown, Iowa, is available in heating capacities of 22,200 and 38,000 Btu per hr, and in cooling ratings of 23,000 and 35,000 Btu per hr, respectively, at ARI standard conditions.

The manufacturer points to a special control feature involving a four-mercury bulb, automatic changeover heating-cooling thermostat. Three of the mercury bulbs are provided with heat anticipation coils to control heating, cooling, and auxiliary electric heat cycles. The fourth keeps the heat pump reversing valve in either heating or cooling position as long as that particular cycle is required. Standard equipment also includes a defrost control, and high pressure safety control. Unit is shipped completely assembled and pre-charged, with controls mounted and wired.

Outdoor and indoor coils have 4-row seamless copper tubing with the standard Lennox ripple-fin, flat bonded for better heat transfer. Air for both coils is pulled through the coil, turned 180°, and discharged in the opposite direction of entry. This permits installation of the unit completely within a structure, with only the face of the outdoor coil exposed, as illustrated. The compressor is resiliently mounted, suction cooled and has accessible gage ports. It is covered by a five year warranty.

More information? Circle Item 88, postcard, last page.

Block Type Filter-Drier

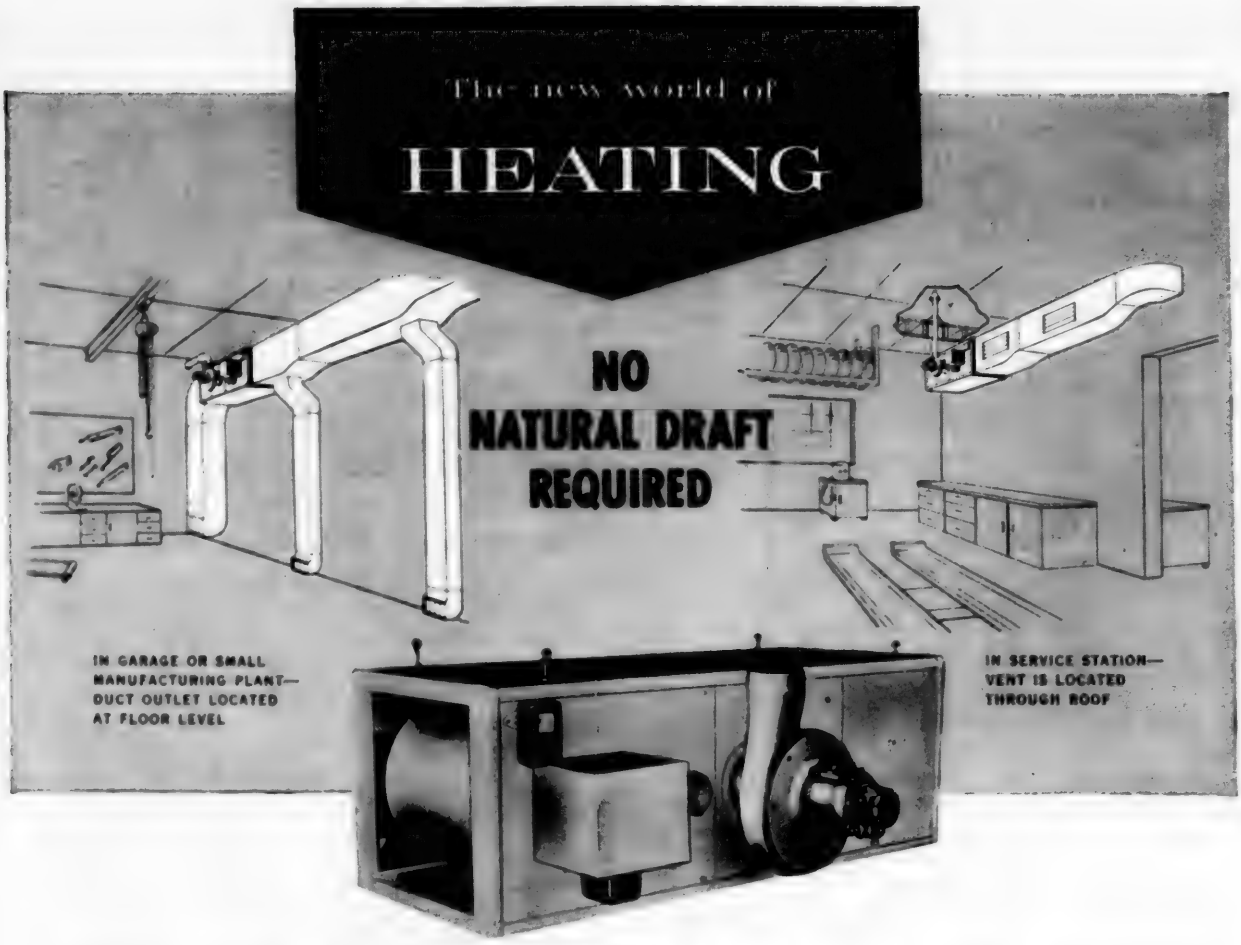
Development of Dri-Kleaner, a block type filter-drier, combining silica gel P. A. 400 and Molecular Sieve, is announced by Alco Valve Co., St. Louis, Mo. Extensive field tests have demonstrated that these desiccants, bonded in rigid form by a process which creates high mechanical strength, will not permit separation under liquid surging or severe shake-up. Further, the geometry of the block exposes maximum surface to liquid flow, assuring even distribution of filtered particles. The result is filtration in depth, the company states, preventing rapid rise in pressure drop. Longer filter-drier life is promised.

In addition to high filtering qualities, the combined desiccants absorb acids and colors and, because of the low amount of binder required for mechanical strength, nearly pure desiccants are used, making it possible to meet ASRE-ARI Standards easily.

Accompanying cross sectional photo shows the desiccant block suspended in the shell with tension spring, additional filtering screen, and filtering and shock pads in position. The filter-drier was developed as a result of research, at the Industrial Chemical Research Laboratory of the University of Miami, made possible by a grant from the company.

More information? Circle Item 89, postcard, last page.

(Continued on page 122)



Now...Iron Fireman CUSTOM Mark II oil fired furnaces

for commercial applications

The new combustion system used in this revolutionary furnace is entirely free from the difficulties resulting from erratic natural draft. It requires only an exhaust vent, which may be less than half the diameter of the usual smoke pipe. In a low roofed service station, for example, the furnace can be hung from the ceiling with only a few feet of vent pipe.

The convenient horizontal shape of this furnace, together with its built-in draft inducer that frees it from chimney problems, makes it especially useful in many commercial applications. Space that otherwise would be wasted, houses a complete heating plant. Can be used with or without warm air ducts in many buildings, including garages, service stations, stores, warehouses and small manufacturing plants. Units can be readily combined with air conditioning systems.

Smoke and soot are completely eliminated, resulting in remarkable savings in fuel and service costs. Sealed combustion chamber eliminates odors and reduces standby loss to practically nothing.

Mail coupon for complete information

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3088 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward St., Toronto)

Please send information on the Iron Fireman CUSTOM Mark II horizontal furnace.

Name _____

Firm _____

Address _____

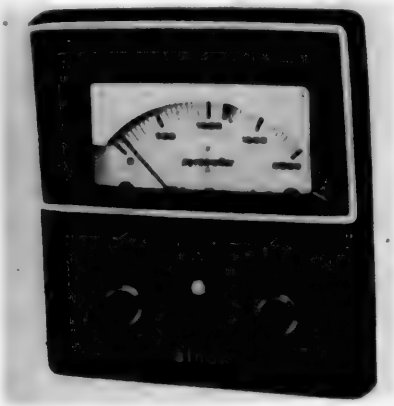
City _____ State or Prov. _____

(Continued from page 120)

Temperature Indicating Controller

An accurate electronic on-off controller and pyrometric temperature indicator is available in a single, compact instrument from Alnor Instrument Co., Division of Illinois Testing Laboratories, Inc., Chicago, Ill.

Called the Alnor Pyrotroller, unit has been designed for use on ovens, heat treating furnaces, environmental



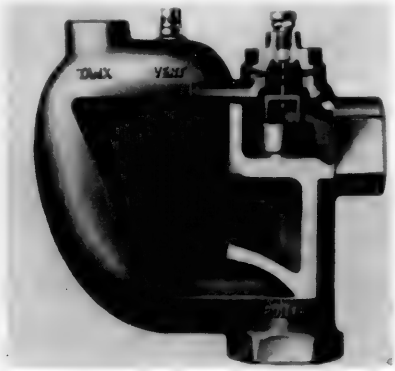
test chambers, die casting machines, injection molding machines, extrusion presses, heat sealing machines, and a multitude of processes requiring precise continuous control. It is suitable for original equipment application as well as field application. The small space required by the instrument case, $6\frac{3}{8}$ x 7 inches, makes it a desirable panel board instrument.

Controller is available in eleven ranges from 0-400 deg F to 0-3000 deg, as well as an environmental test chamber range of −100 to +300 deg. Currently offered are single and double target models. Additional models will be available in the near future.

More information? Circle Item 90, postcard, last page.

Air Eliminator—Flow Check

A combination air eliminator and flow check, designated Type 5000, is introduced by Watts Regulator Co., Lawrence, Mass., as a new design for hot water space



heating systems. A one-piece casting, it includes an air eliminator, flow check, and automatic air vent. A tapping is available for the expansion tank line.

Because its internal construction creates a flow path which directs air to the surface for fast removal, the air eliminator portion provides noiseless, efficient air elimination, the company states. The flow check prevents gravity flow and permits summer operation of the domestic water unit. (A Type 5100 is furnished without the flow check and air vent for use as an air eliminator only.)

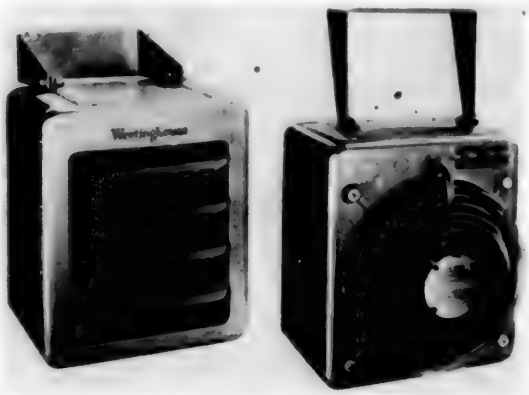
The company visualizes a large market for it because of its initial low cost and the fact that it eliminates the need for contractors to stock and install several separate devices to achieve the same result. Because it can be installed directly on the riser, installation is faster and less expensive.

More information? Circle Item 91, postcard, last page.

Electric Unit Heaters

A line of electric unit heaters for office, store, institutional and industrial installations has been introduced by Air Conditioning Div., Westinghouse Electric Corp., Staunton, Va. The units are available in a range of sizes from $1\frac{1}{2}$ to 36 kw with either manual or automatic control.

Heaters mount out of the way on a wall or from a



ceiling and provide the advantages of electric heating: instant heat with controlled circulating, and elimination of a heating flame. They can be applied in a wide range of applications, including freeze prevention and drying processes.

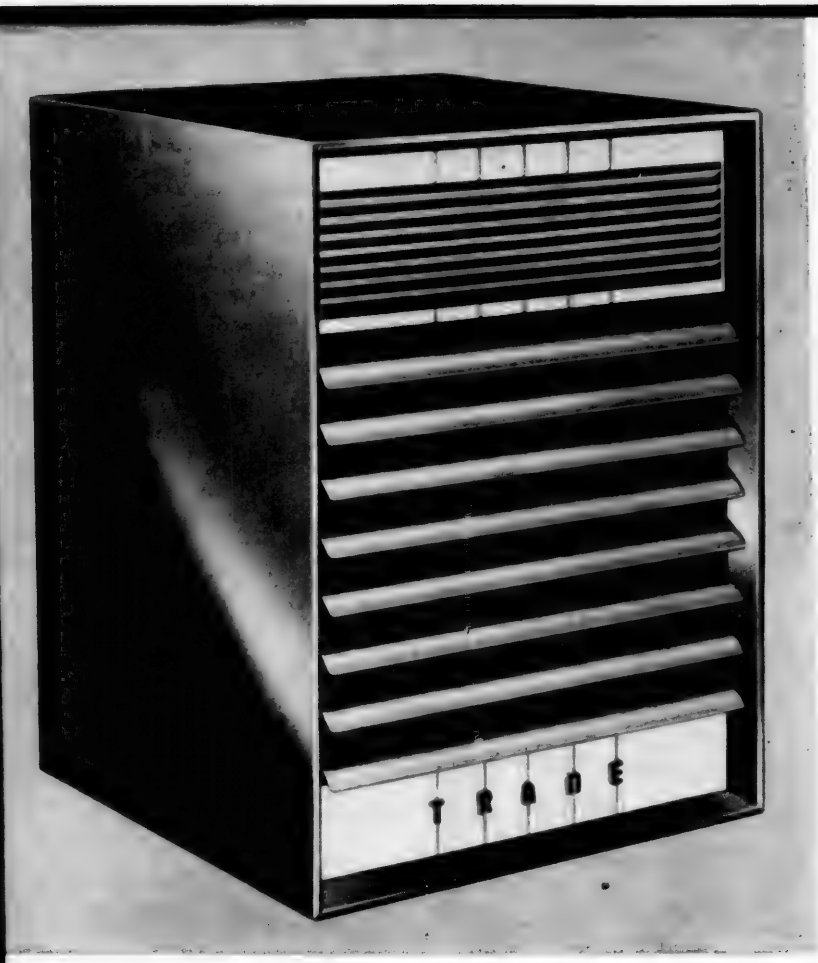
Units are available in two styles: $1\frac{1}{2}$ up to $7\frac{1}{2}$ kw and 9 to 36 kw. In the smaller ratings, the heaters provide up to 25,590 Btu per hr with fan capacity of 380 cfm. The units with larger ratings provide over 122,000 Btu per hr with fan capacities up to 2560 cfm.

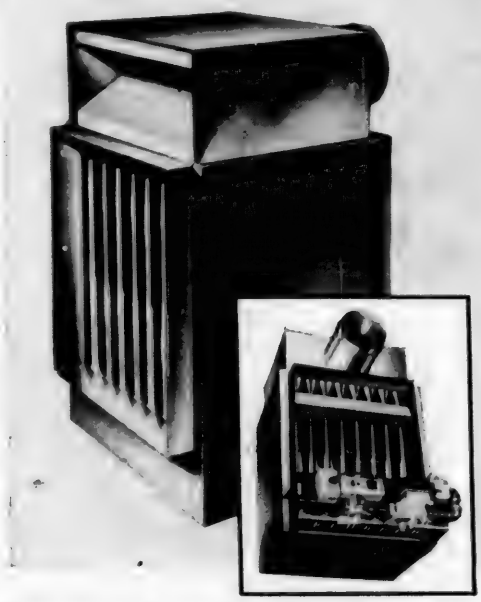
The fan drives are direct connected to eliminate belt maintenance. The heating element is of spiral design, steel sheathed, and is replaceable. All the fanwheels are balanced and made of aluminum.

Each heater has built-in protection that shuts off the unit to prevent overheating. In addition, adjustable air stream louvers provide even heat with controlled circulation.

More information? Circle Item 92, postcard, last page.

(Continued on page 124)





Duct heater is suitable for downstream operation in accordance with latest codes. Provides heating cycle for remote cooling units, such as the TRANE Self-Contained Air Conditioner. Drain pan (shown in inset) is standard equipment. The unit has low static resistance, is of aluminized construction. Operational modulation valve reduces input as much as 80%. 2-stage, 2-input valve available.

Propeller-type heater uses a new, quiet TRANE Fan that is designed exclusively for unit heaters. Access door on bottom of casing makes unit easy to clean. Complete range of sizes from 33,000 to 250,000 Btuh input.

New Trane gas-fired heaters have advanced styling, compact design!

High-performance blower and propeller units—plus duct models approved for downstream operation

Here's a new line of gas-fired heaters from TRANE that combines smart, modern appearance with peak performance and versatility! These TRANE Heaters are ruggedly built for long life—yet they're light in weight, compactly designed for use where space is at a premium.

Three basic types are available: propeller, duct and blower. All models feature an aluminized steel, all-welded heat exchanger that assures long, trouble-free operation. The steel, ribbon-type burners have stainless steel inserts. And the burners are removable individually for service and maintenance.

The TRANE Duct Heater may be used for downstream operation, for use with remote cooling units (such as the TRANE Self-Contained Air Conditioner). All parts of the duct heater that are exposed to the cold air stream are of aluminized construction—including the drain pan, which is standard equipment.

True 2-speed, 2-input propeller units available in 5 sizes. The motor speed and gas input can be automatically cycled to maintain more even temperatures; to provide greater operating economy.

The light weight of these new TRANE Heaters means more Btu's per pound. Freight costs are lower; and installation is simplified: minimizes the need for expensive structural reinforcement.

WANT MORE FACTS on these gas-fired heaters? Just ask your nearby TRANE Sales Office; or write TRANE, La Crosse, Wisconsin.

Blower-type heater uses a forward-curved centrifugal fan. Free delivery or duct work installation; adjustable fan belts to provide proper air delivery against varying static pressures. Streamlined fan inlet for exceptionally quiet operation. Louver-Fin Diffusers increase air throw. Sizes from 33,000 to 250,000 Btuh input.

For any air condition, turn to

TRANE

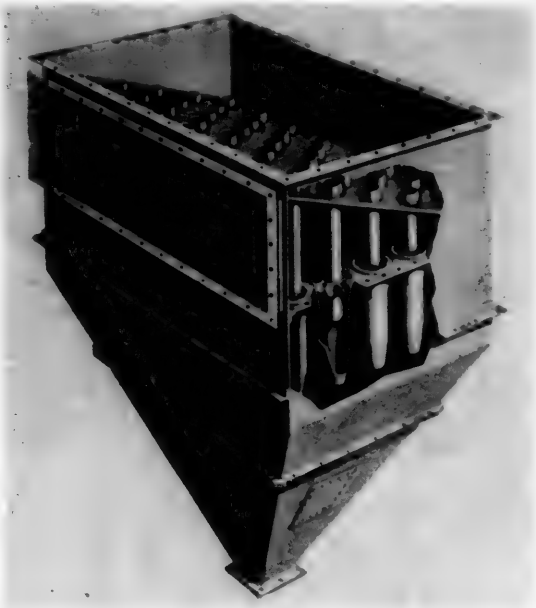
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA.
CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY
OF CANADA, LIMITED, TORONTO • 100 U. S. AND 19 CANADIAN OFFICES

(Continued from page 122)

Cyclone Collector

A cyclone collector is the most recent addition to the line manufactured by Air Pollution Control Div., John Wood Co., Bernardsville, N. J.



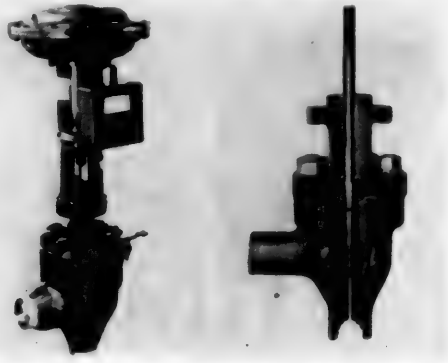
According to the manufacturer, this unit is designed for maximum flexibility and ease of installation, with a high efficiency over a broad range of dust particle sizes. Although the collector is a standard unit, several types are available for use in the power, cement, steel, and similar industries.

In addition to the collector, the Division offers Yerzley scrubbers, bag filters, and engineering services for turnkey pollution control installations. A brochure with specifications of the collector is available.

More information? Circle Item 93, postcard, last page.

Low-Noise Throttling Valve

"Quick-change" trim can be replaced in minutes without opening line piping in a new, low-noise



throttling valve for high-pressure liquid and steam announced by Republic Flow Meters Co., a subsidiary of Rockwell Manufacturing Co., Chicago, Ill. Maintenance time is cut because the valve plug, guide and seat can be replaced in little more time than required to open and close a bolted joint.

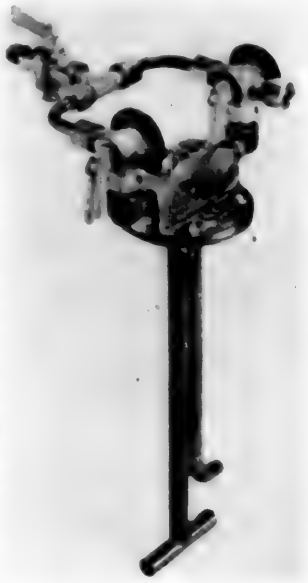
Designated the V-10, valve is designed for severe service where pressure drops may be as high as 3500 lb or where flashing may occur. These flow control valves are angle-style, diaphragm-operated, and are available in 1500, 2500, and 4500-lb classes, from 1½ through 4-inch sizes.

According to the manufacturer, quiet operation in the new valve results from flow being parallel to the internal valve surfaces. This induces uniform velocities and reduces impingement of fluid. Trim can be selected for linear, equal-percentage, straight-taper, or shut-off response.

More information? Circle Item 94, postcard, last page.

Pitot Tube for Dusty Air

A pitot tube developed by the F. W. Dwyer Mfg. Co., Michigan City., Ind., measures air or gas velocity and pressure in dry dust or dirt laden environment. Called a purge clean-out pitot tube, its blow out system uses compressed air to clear its total pressure probe and static pressure element of obstructions. A 3-way valve prevents direction of blow out pressure toward the gage or manometer. The unit is constructed of all brass and stainless steel and is silver soldered for operation in temperatures up to 800 deg F.



All tubing and piping, including one compressed air connection, is incorporated in a compact assembly. Careful design eliminates small static openings, pockets or dead end spaces where dust might lodge and resist blow out. For stacks or chimneys in cement plants or flour mills or similar environments, the unit will provide infinitely more accurate measurements than conventional pitot tubes under the same conditions, the company states.

Five tube sizes are available: nominal insertion lengths of 3, 6, 12, 18 and 24 inches are suitable for ducts with diameters of 6, 12, 24, 36 and 48 inches, respectively. Each assembly weighs approximately 2 lb.

More information? Circle Item 95, postcard, last page.

(Continued on page 126)

NEW ANACONDA COST-CUTTING KITS—to help you rough in hot and cold water lines FASTER, EASIER, BETTER

1. Nail strap to studs—no blocking, no sawing, no notching to avoid vents.

2. Fasten fittings to the perforated strap with self-tapping screws.

3. Solder the fittings to the risers—and the installation is complete.

Kits for every need

90° ELLS

1707-3-5A	Copper to F.S.P.S.	⅜"
1707-3-5A	Copper to F.S.P.S.	½"
1707-3-5A	Copper to F.S.P.S.	½" x ⅜"
1707-5A	Copper to Copper	½"

TEES

1711-5A	Copper to Copper to Copper	½"
1712-5A	Copper to Copper to F.S.P.S.	½" x ½" x ⅜"
1712-5A	Copper to Copper to F.S.P.S.	½"

THRU-WALL ADAPTER

1703-5A	Copper to F.S.P.S.	½"

Convenient—Reasonably Priced

EACH ANACONDA QUIK-RUF KIT CONTAINS: 10 Anaconda High Ear Fittings, 6 Stud Straps, 20 Self-Tapping Screws, and 12 Nails.

These new Anaconda Quik-Ruf Kits are sold by distributors of Anaconda Copper Tube and Fittings. The prices are right. So get a stock of kits now and start saving time and money right away.

ANACONDA®

COPPER TUBE AND FITTINGS

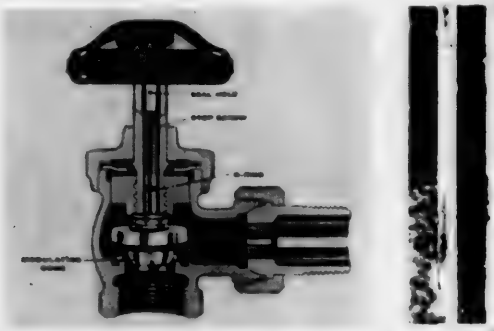
Products of The American Brass Company

(Continued from page 124)

Adjustable Orifice Valve

An easily adjustable orifice valve, called the R-105, which permits accurate balancing of steam and hot water systems is available from Marsh Instrument Co., Div. of Colorado Oil and Gas Corp., Skokie, Ill.

A stop screw in the valve stem provides a full range of orifice adjustments without the necessity of shut-



ting down the system or breaking the union connection. Such adjustments are accomplished by a modulating cone, which may be set to increase or decrease flow. Positive shut-off is possible at all times without disrupting the orifice setting.

On steam systems, the R-105 is adjustable from 10 to 100 sq ft of E.D.R. On hot water jobs, flow through the valve, at any given pressure, can be adjusted to assure proper flow through the heating element.

The packless valve is available in ½, ¾ and 1-inch sizes, and in angle, straight or corner patterns. It can be sealed on the job against tampering.

More information? Circle Item 96, postcard, last page.

Self-Contained Radiator Control

Thermotrol, a compact, self-contained, control valve, is available from Sterling, Inc., Milwaukee, Wis.

As easily installed as an ordinary radiator valve, the company states, unit is not an on-off control, but modulates the flow of steam or water to the radiator to maintain a constant temperature within 1½ deg F.

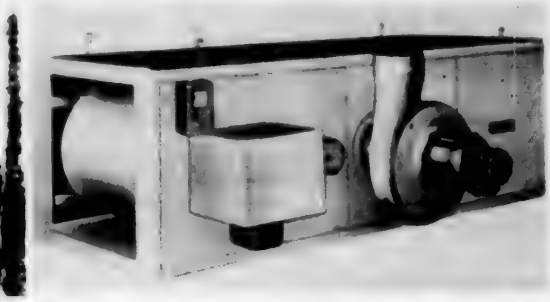
Settings may be adjusted by turning the graduated dial to any point between 60 deg and 80 deg. Dial may be locked to prevent tampering.

The company recommends its valve especially for those cases where there are a number of radiators in a system, some in cold spots, others in warmer locations. In these applications, the control permits individual radiator adjustment, so that heat distribution is in balance throughout the system. Literature on the valve is offered.

More information? Circle Item 97, postcard, last page.

Horizontal Oil-Fired Furnace

The Custom Mark II oil-fired furnace is now available in a horizontal form for use in homes and small commerical buildings. Manufactured by Iron Fireman Mfg. Co., Cleveland, Ohio, the furnace eliminates the need for the usual chimney. Only a vent to handle exhaust is required, where local codes permit.



In commercial installations, as garages, stores, service stations, warehouses, and small manufacturing facilities, furnace can be suspended from the ceiling in any convenient spot and operated with or without ducts. It is available in six heating capacities, with an output rating at the bonnet of from 84,000 to 250,000 Btu per hr.

According to the manufacturer, the horizontal furnace burns cleaner and uses materially less fuel than other models because of the exceedingly intimate fusion of oil and air achieved by the instant draft volumetric combustion system. Unhampered by erratic conditions, furnace does not create soot or dirt.

More information? Circle Item 98, postcard, last page.

Gas Leak Detector Liquid

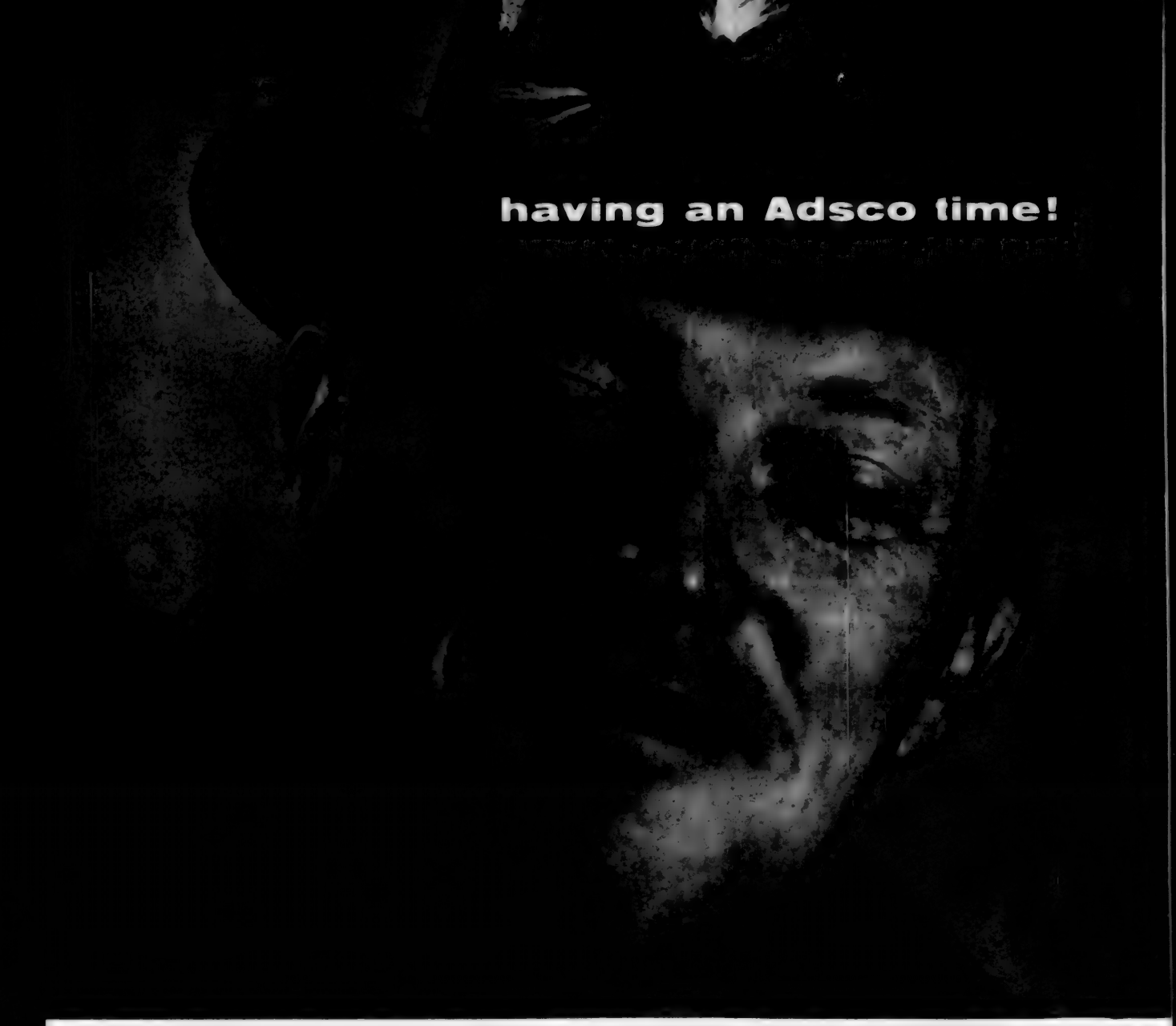
Extremely small leaks of any compressed gas are said to be easier to locate with Calgon gas leak detector, a high-velocity liquid which forms bubbles when daubed on pipe joints where leakage is suspected.

According to the manufacturer, Calgon Co., Pittsburgh, Pa., the liquid leaves no deposit, is harmless to skin and non-staining, can be used with safety and without danger of fire, and is non-freezing. It functions efficiently with any compressed gas, including air, carbon dioxide, nitrogen, natural gas, and all refrigerant gases.

Packed in 6-oz unbreakable plastic bottles, the detector fluid comes with a stainless steel dauber rod.

More information? Circle Item 99, postcard, last page.

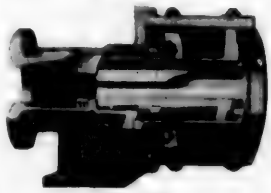
(Continued on page 128)



ONLY ADSCO HAS ALL 3 TYPES OF EXPANSION JOINTS

CORRUFLEX PACKLESS

RAM-PAK



SLIP TYPE

. . . real peace of mind, the result of doing business with completely reliable Adsco. For more than 80 years, Adsco has carefully handled customers' expansion problems in their piping systems, from engineering through manufacture. Consult Adsco for your peace of mind.

Write for comprehensive catalogs

ADSCO ENGINEERED PRODUCTS

Sold, Engineered and Manufactured by

YUBA HEAT TRANSFER DIVISION

HONESDALE, PA.

World's Oldest and Largest Manufacturer of Packed and Packless Expansion Joints

YUBA

YUBA CONSOLIDATED INDUSTRIES, INC.

YUBA — A growth corporation serving growth industries

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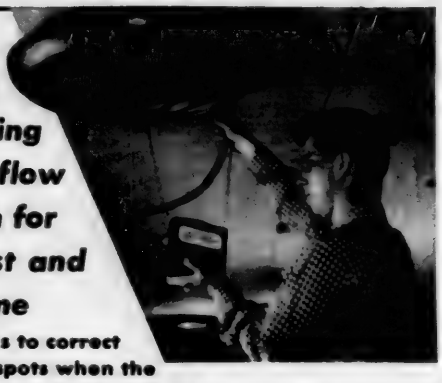


This man is balancing an air flow system for the first and last time

No call backs to correct hot or cold spots when the system is set up right the first time with an

Alnor VELOMETER®

Instant reading of air flow, in feet per minute, at outlets and draw of air at returns gives an accurate check on engineered systems.

The Velometer will also give direct readings of static pressure in ducts, plenum chambers, or pipes. Registers pressure loss across heater and filters, friction loss at ells and deflectors. Many government and municipal jobs require Velometer checking before acceptance.

The Velometer, set No. 3G recommended for commercial heating and air conditioning, is priced at only $194.00 including a sturdy reinforced carrying case.

Alnor INSTRUMENTS

ILLINOIS TESTING LABORATORIES, INC.
Room 570 420 N. LaSalle St., Chicago 10, Ill.

STEAM TRAP TESTING

is accurate and positive with an

Alnor PYROCON®

If the steam trap is clogged or blowing steam to the point where the hand test indicates poor functioning, it has gone too far. But the Alnor Pyrocon, by instantly registering the temperatures on each side of the trap, will spot trouble right at the start before failure becomes serious.

The Alnor Pyrocon saves its cost many times over and over again in time saved locating a poorly operating steam trap. Price for the model 4000 complete is only $135.00. Bulletin No. 4257 gives complete Pyrocon information.

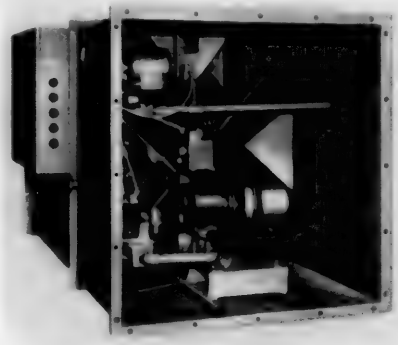
Alnor INSTRUMENTS

Pyrometers-Velometers-Dewpointers
ILLINOIS TESTING LABORATORIES, *Inc.*
Room 570, 420 N. LaSalle St., Chicago 10, Ill.

(Continued from page 126)

Four Make-Up Air Units

A redesigned line of gas-fired air intake units for supplying make-up air to replace that removed by exhaust systems is available from Hartzell Propeller Fan Co., Piqua, Ohio.



Four basic units range from 15,000 to 90,000 cfm and 1,000,000 to 7,000,000 Btu per hr. Basic unit includes burner, controls, and belt- or direct-driven fan in a single housing. It is shipped assembled to meet job requirements with optional accessories including turning elbow, shutters, filter house, and outlet diffusers. Control systems can be supplied to meet all operational, local code and insurance agency approval requirements, the company states.

More information? Circle Item 100, postcard, last page.

Six Refrigerant Containers

A complete line of new refrigerant containers was announced by Freon Products Div., E. I. Du Pont de Nemours & Co., Wilmington, Del. According to the company, the line was developed after two years of research and a million dollars in new investment.

Cylinders hold the company's complete line of Freon

12 and Freon 22 refrigerants. Shown left to right in photo are the new Zephyr 25- and 50-lb containers, the new Spintop 25-lb cylinder, and the standard 10-, 25-, and 145-lb cylinders. Handwheel-operated valves add to the convenience of the Zephyr and Spintop containers.

More information? Circle Item 101, postcard, last page.

(Continued on page 130)

Quiet...

WAGNER Polyphase Resilient Mounted Motors in ratings through 10 horsepower

Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

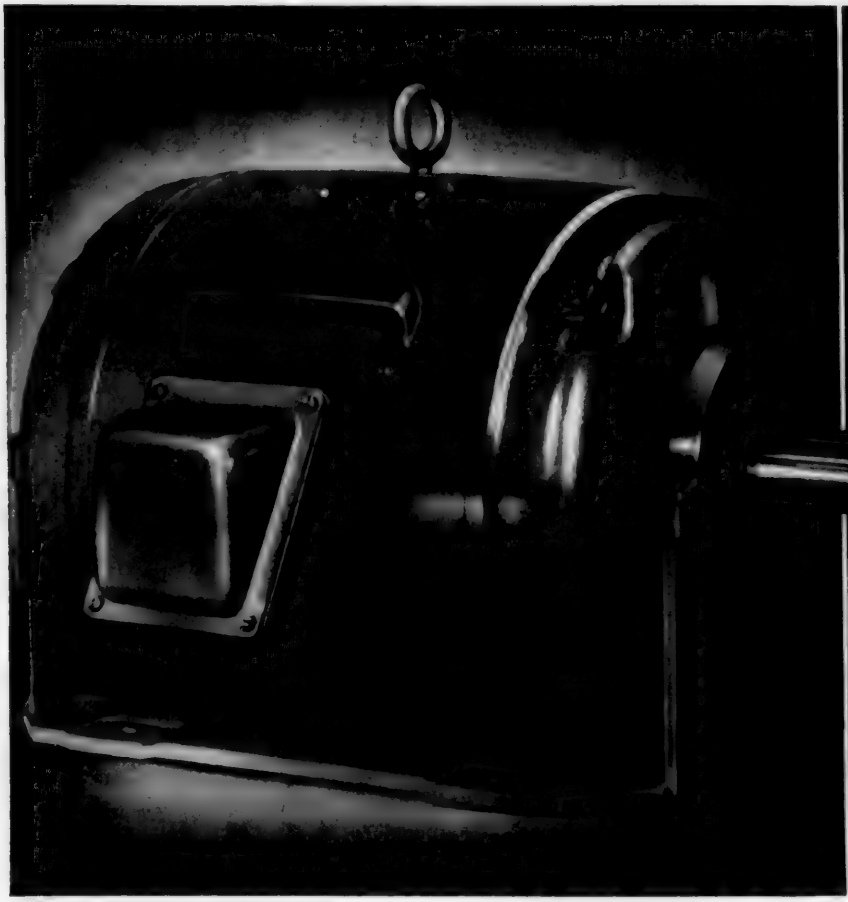
You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

Your nearby Wagner Sales Engineer can help you select the right motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

Wagner Electric Corporation
6463 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM60-14



SLEEVE OR BALL BEARING
These motors are furnished with quiet running steel-backed babbitt-lined sleeve bearings of high load carrying capacity. Ball bearings can be supplied when desired.

CEILING, SIDEWALL OR HORIZONTAL MOUNTING
You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. Motor stays dripproof.

NEOPRENE CUSHIONING RING
Annular mountings, of oil-resistant neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.

One single source of burners for most every application—that's what Power Flame offers you! In the fact-packed Power Flame Catalogue, you'll discover a complete range of models and sizes in atmospheric burners, power burners and combination burners. All designed for lowest installation and maintenance costs... all "torture tested" for highest efficiency and dependability. Hot idea: Next time, consult Power Flame *first!*

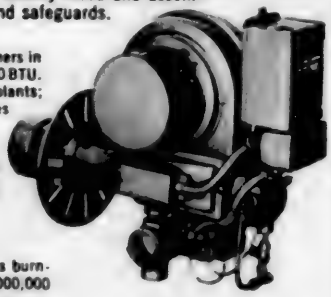
Power Flame GAS BURNERS

A model to fit every residential, commercial and industrial application. Completely factory wired and assembled, with modern controls and safeguards.

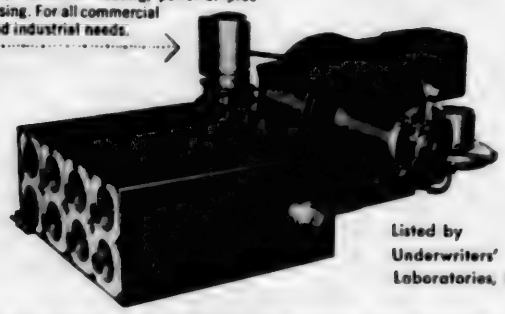
FG Series—Gun type gas burners in series to deliver 85,000 to 4,000,000 BTU. Adaptable to all types of heating plants; ideal for homes, schools, churches and commercial buildings

Flange or pedestal mount optional

A. G. A. Listed



BFG Series—Spread type gas burners; models from 450,000 to 20,000,000 BTU. Ideal for heating, power or processing. For all commercial and industrial needs.



Listed by Underwriters' Laboratories, Inc.

Write today for complete literature, information, and specifications on POWER-FLAME gas burners. Also get all the facts about THORO-MIX gas burners, and COMBI-MATIC dual fuel burners.

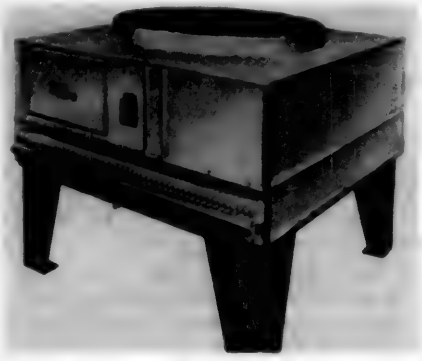
Power Flame Division, Inc. / 1203 MAIN ST. GRANDVIEW, MO.

(Continued from page 128)

Air-Cooled Condensers

A complete range of air cooled condensers, from 8 to 85 tons in a single unit, for all air conditioning and refrigeration applications is available from McQuay, Inc., Minneapolis, Minn.

Thirteen sizes of horizontal and vertical air flow Aircons for all engineering requirements are available



with unlimited capacity in multiple unit installations.

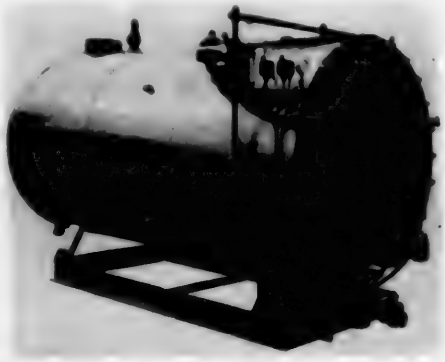
Rigid, heavy-gage continuous galvanized steel construction makes these units quiet in operation, the company states. The company's Seasontrols, automatic head pressure controls, are available as accessories, and modulate the condensor capacity in accordance with weather for proper operation at all times. Complete specification information is offered.

More information? Circle Item 102, postcard, last page.

Automatic Packaged Boilers

Fully automatic Husky packaged boilers are announced by Western Boiler Co., San Francisco, Calif., in sizes from 10 to 125 boiler hp, for light oil, natural gas or combination gas-light oil operation.

Units are of compact three-pass design. A single

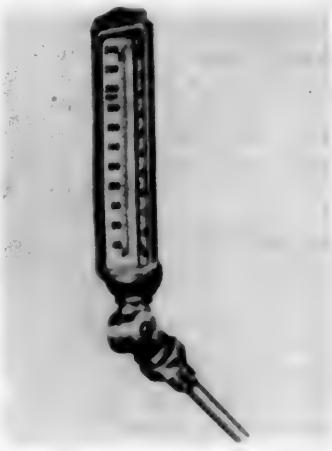


motor drives both fan and oil pump. Forced draft eliminates necessity for tall stacks or other auxiliary draft equipment. Complete operating and flame safeguard controls are standard in enclosed cabinet. Low-fire start is standard, but full modulation on both oil and gas is available.

More information? Circle Item 103, postcard, last page.

Adjustable Industrial Thermometers

Adjustable angle industrial thermometers, introduced by Moeller Instrument Co., Richmond Hill, N. Y., are designed to eliminate selection problems for varying pipe line and airduct requirements. Instruments can be angle-adjusted on the job to meet piping layout changes.



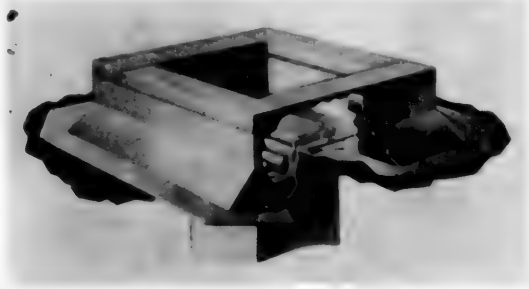
Stem tilts or rotates to any angle for easy reading without parallax error. Positive locking, brass universal joint with stainless steel lock screw permits adjusting into desired position before, during, or after installation. Capillary is totally enclosed. Numerous other niceties in detail are featured.

Thermometers are available with standard separable sockets for pipelines, with extension neck sockets for insulated lines, and with adjustable stems for air duct installations.

More information? Circle Item 104, postcard, last page.

Prefabricated Roof Curb

Time and cost saving installation of roof ventilators is possible through use of a high quality, prefabricated roof curb manufactured by Swartwout Fabricators, Inc., Kokomo, Ind. Called Insta-Curb, these units are constructed of heavy gage painted steel. All joints are welded; base and separate corner cants are said to



reduce possible leak points and prevent the tearing of roofing materials.

Featuring full fiber glass insulation between double shell construction, the curb has a wood top which facilitates ventilator mounting. Ventilators, ducts and louvers install quickly and easily, the company reports.

The curb is available to fit roof openings from 10 by 10 inches to 36 by 36 inches, with outside top curb dimensions of 20 by 20 inches to 52 by 52 inches.

More information? Circle Item 105, postcard, last page.

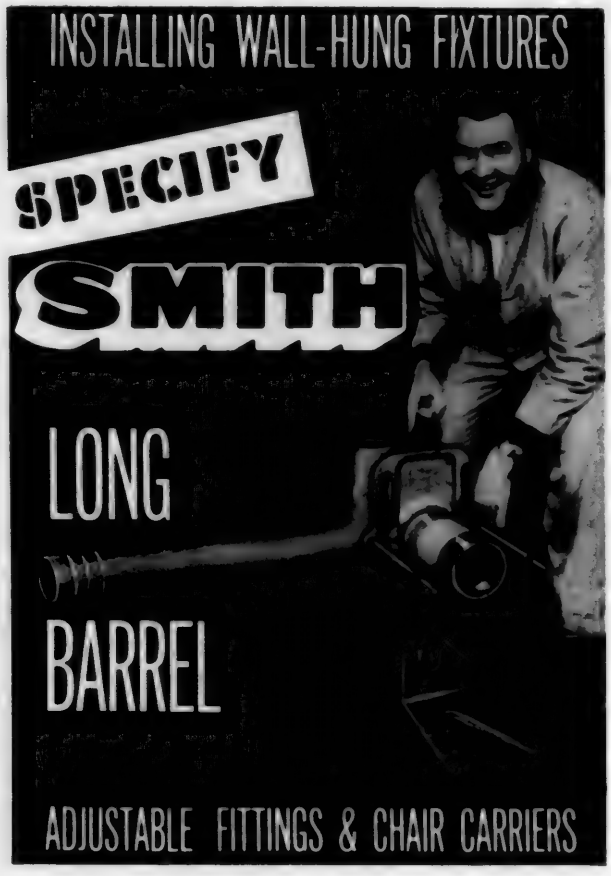
No Need to Look Further...

Write today for nearest representative

WESTERN ENGINEERING AND MFG. CO.

P.O. Box 66455
Los Angeles 66, California

Complete Catalog in Sweets. Member Air Moving and Conditioning Assoc., Inc.



Make the Job
PLUMB-EASY

CUT COST
SAVE TIME, MATERIAL

On horizontal battery runs, the new Jay R. Smith Caulked Long Barrel Fittings make Wall-Hung Fixture installations "PLUMB-EASY."

Providing an extra long spigot, Long Barrel Fittings permit caulked carrier fittings to be installed on 36" (or less) centers without requiring additional piping, and eliminating the caulking of extra joints.

Saving time and material, Smith Long Barrel Fittings cut cost and make a stronger, neater installation.

Long Barrel Fittings are furnished with cut-off rings to permit setting on centers from 30" to 36".

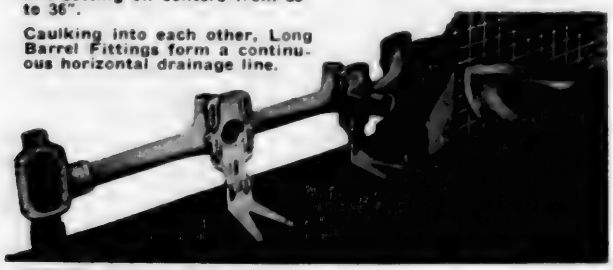
Caulking into each other, Long Barrel Fittings form a continuous horizontal drainage line.

5A-HR 20

3A-HR-20

5A-DH-20

3A-DH-20

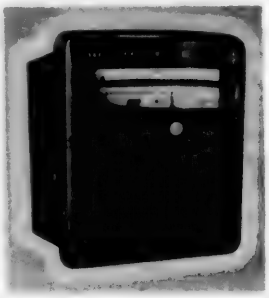


JAY R. SMITH MFG. CO. Union, New Jersey PLUMB-EASY

CHAIR CARRIERS · DRAINS · INTERCEPTORS

New Pressure Indicator

Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill., announces a new pressure indicator. Styled in the manner of the company's "400" Series, this instrument incorporates a measuring system and d-c power supply in a single integral unit. A Zener diode circuit is used to regulate the voltage. The zero and span adjustment can be conveniently adjusted from the power chassis of the instrument.



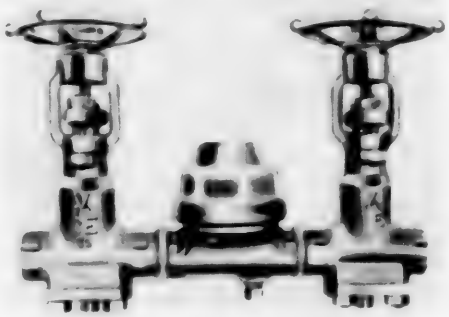
The plug-in type measuring system of the instrument is essentially a d'Arsonval movement compensated for ambient temperature conditions. A linear scale is used. The full scale span in millivolts is between 4.9 and 5.5.

Plug-in type control chassis may be used as part of this product where pressure control is required, thus making it an indicating pressure controller.

More information? Circle Item 106, postcard, last page.

Unit Combines Steam Trap, Valves

According to Velan Steam Specialties, Inc., Plattsburgh, N. Y., every steam trap installation requires two or more shut-off valves to isolate the trap for repair or inspection. The installation cost is high due to the number of connections needed, and labor far exceeds material cost. The company reports that great savings can be effected by use of its newly-developed Type TSV Piping King.



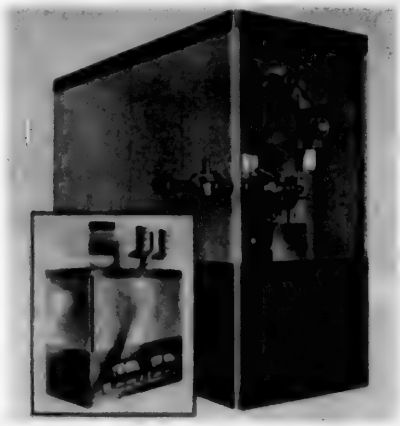
This combination unit consists of a forged steel Type TS steam trap with integral strainer, check valve and air vent, welded to either one or two forged steel gate valves. Both trap and valves are completely serviceable in the line in less time than it would take to remove a standard trap or valve.

Type TSV is produced in ⅜ through 1-inch connection sizes for pressures up to 250 psi. Other models are available to 2000 psi and 1050 deg F.

More information? Circle Item 107, postcard, last page.

Multi-Purpose Furnace

Series OG4 dual-fuel heating units, announced by Lennox Industries, Inc., Marshalltown, Iowa, are designed to be used as central furnaces, as unit heaters with directional discharge nozzles, or as duct furnaces with the ability to be used with future industrial air



conditioning. They can be installed for up-flow, down-flow, or horizontal delivery, and are UL listed.

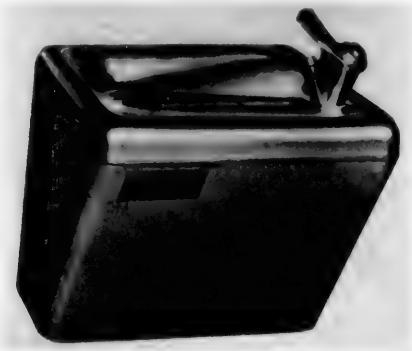
Either No. 2 fuel oil or gas are burned in single burner assembly with fuel selection by manual switch. Output capacities, for either fuel, are 750,000 or 1,000,000 Btu per hr.

Each unit comes factory wired and includes a main line switch, blower starter, summer-off-winter switch, limit control, fan control, and terminal strip.

More information? Circle Item 108, postcard, last page.

Auxiliary Wall Fountain

An auxiliary wall fountain, to match the basic design and color of its line of self-contained drinking water coolers, is offered by Temprite Products Corp., Birmingham, Mich. Model No. WF-4000 will serve as an extra cool water outlet for busy locations; or it may



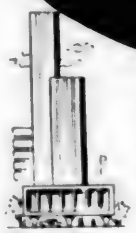
be mounted on a wall opposite the self-contained cooler, in an adjoining room.

Easily mounted at any desired lower height, it is ideally suited as a companion fountain for children.

More information? Circle Item 109, postcard, last page.

Sterlco

THERMOTROL



Schools, Offices and Apartments

Institutions, Hospitals and Public Buildings

ACCURATE, INDIVIDUAL ROOM TEMPERATURE CONTROL . . . FOR STEAM OR HOT WATER SYSTEMS

EVEN HEAT

Controls each unit of radiation independently . . . provides heat only when temperature in room or small area falls below Thermotrol setting. Eliminates thermostats and zone valves.

SAVES FUEL

Thermotrol installations often pay for themselves in fuel savings. Prevents overheating and waste of fuel. Excellent for correcting unbalanced systems. Heat used only when and where it is needed.

EASILY INSTALLED

Completely self-contained . . . requires no connection to power supply, or external control device. As easy to install as ordinary radiator valves.

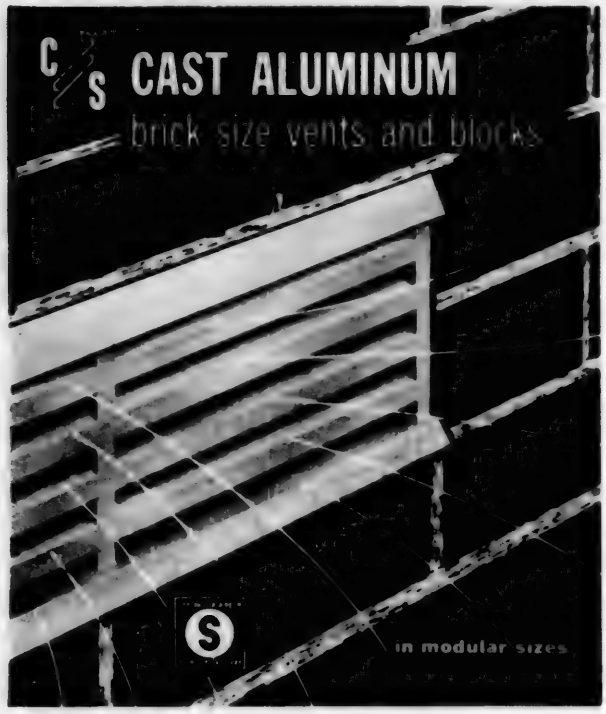
Leaders in temperature controls since 1916

Sterling inc.

5206 W. Clinton Ave., Milwaukee 23, Wisconsin

THE
neat
ANSWER

to air intake and exhaust
for unit air conditioners and other ventilation requirements



clean-cut in appearance
rugged in construction
high free area
economically installed

16 modular bricks and blocks
—fit in neatly as the wall goes up.
Sizes for standard and jumbo brick, and cinder or concrete block construction.
A wide variety of finishes, protective lacquers, and color coatings for every job requirement.
A complete line of accessories.

C/S Brick Size Vents and Blocks
are approved by leading air conditioning manufacturers, they are certified tested and comply with F.H.A. regulations.
They have been proved in thousands of installations!

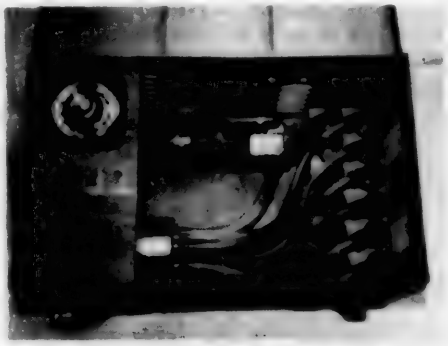
Representatives in all principal cities—same day shipment.

Write Department B for catalog—test data, price and specification details.

CONSTRUCTION SPECIALTIES, INC.
55 Winans Ave., Cranford, N. J. • P. O. Box 457, Escondido, Calif.

Sequential Air Sampler

A sequential sampler for air analysis, offered by Gelman Instrument Co., Chelsea, Mich., is said to fill the need for a small, portable instrument which will



automatically collect air samples for subsequent analysis of contamination. It can be used for either gas determination or dust counting, or both together.

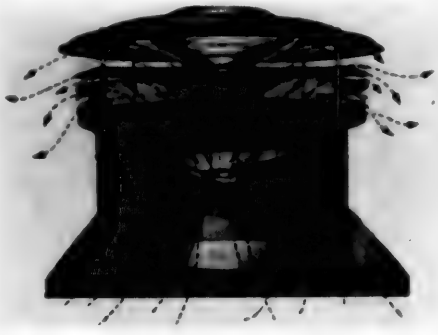
In studies of air pollution or dust contamination, it is often essential to have a record of contamination over a period of time, the manufacturer explains, but it is not practical to have personnel take samples around the clock. Automatic equipment is expensive.

The sampler consists of a vacuum pump connected to a 12-position valve, which is in turn connected to 12 gas collectors or filter holders. The valve is automatically switched from one position to the next, so that 12 samples of air are collected in sequence. At the end of 12 samples, the sampler shuts itself off.

More information? Circle Item 110, postcard, last page.

Automatic Damper on Exhauster

Model PRE power roof exhauster, announced by Genie-Air, Inc., Los Angeles, Calif., features a diverter-damper. Completely automatic in operation, the spun-aluminum cone-shaped damper is lifted by the



column of discharge air and seated against the unit's cover, which diverts the flow of air radially. When the fan is turned off, damper settles back and closes the exhaust opening, providing a weather-tight seal. Support and damper guide rods are neoprene coated for smooth operation.

More information? Circle Item 111, postcard, last page.

Thermoplastic Ball Valves

Development of a line of top-entry, top-adjusting thermoplastic ball valves is announced by Tube Turns Plastics, Inc., Louisville, Ky.

The valves, formed by company's exclusive process of injection molding, are made of unplasticized polyvinyl chloride for operating temperatures to 150 deg F, and of Penton (new chlorinated polyether) for hot

corrosive service to 250 deg and higher. They come in ½ through 3-inch nominal pipe sizes, threaded or socket type.

Top-entry feature of the ball valve makes it possible to perform on-the-line maintenance almost instantaneously. Quick, easy access to working parts without disconnecting any piping is achieved by simply unscrewing the valve bonnet and lifting out the molded, one piece ball-and-stem and self-lubricating Teflon seating inserts.

More information? Circle Item 112, postcard, last page.

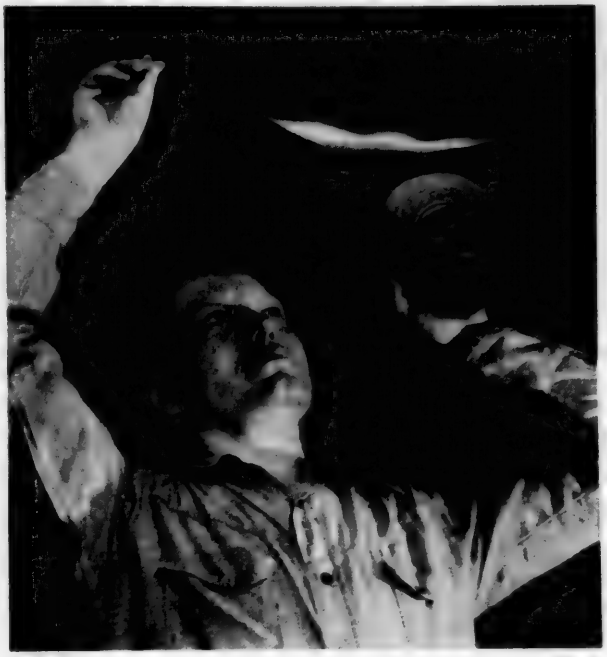
For Steam-Traced Piping

A line of cast aluminum fittings for the installation of extruded aluminum integral steam-traced piping is

announced by Alcast Fittings, Claymont, Del.

Traceline fittings in seven nominal sizes, 1, 1½, 2, 3, 4, 6, and 8 inches, are available in 90° to 45° short radius bends, tees, crosses, 45° laterals, and eccentric reducers.

More information? Circle Item 113, postcard, last page.



Arno® DUCTAPE
TRADEMARK

Quickest and Surest Way to Seal Ducts and Insulation

Use a handy roll of Arno Ductape. It sticks instantly and permanently to any surface. For irregular or difficult-to-reach joints tear the tape off in strips for easy application. Where extra safety against fire hazard is needed use Arno F-R (Flame-Resistant) Ductape.

Arno Ductape comes in 60-yard rolls 1, 1½ and 2 inches wide (or wider if needed). Colors are black, tan, olive drab and aluminum gray. It's specially made for duct sealing and other heavy duty jobs.

If you haven't yet tried Arno Ductape ask your jobber or write for a sample roll. You'll like it and the time it saves.

Arno® ADHESIVE TAPES, INC.

Warehouses at New York, Detroit, Atlanta, Minneapolis, Ft. Worth and Los Angeles. Sales offices in other principal cities.

ARNO ADHESIVE TAPES, INC.
Dr. Scholl's Adhesive Tapes Division
4106 Ohio Street, Michigan City, Indiana

Please send me a free 15-ft. sample. ☐ Flame-resistant, ☐ Non flame-resistant. I am a ☐ Jobber, ☐ Contractor.

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City_____ State_____

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OR EXHAUSTING EFFICIENCY
AT LOWEST COST

Patents 2,722,372 and 2,855,874 and Patents Pending plus Exclusive Foreign Patents

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Quickdraft

POWER-DRAFT UNITS
DESIGNED FOR RESIDENTIAL,
COMMERCIAL AND INDUSTRIAL
APPLICATIONS

★ No motors, fans or bearings in exhaust line ★ Needs no stacks ★ Acid-resisting vitreous enamel finishes ★ Extremely high static pressures now available

FOR HEATING PLANTS AND INCINERATORS . . . *Quickdraft* provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall, unsightly stacks are unnecessary.

FOR INDUSTRY . . . *Quickdraft* now offers extremely high static pressures for EXHAUSTING corrosive gases, abrasives and paint sprays . . . for CONVEYING all types of bulk materials or wastes that can be moved by air.

FOR MOVING AIR in or out of buildings through ducts . . . *Quickdraft* is outstanding in performance and efficiency.

9010-QD

IMPORTANT NOTICE

To withstand corrosive gases, all *Quickdraft* units are available in standard acid-resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P. V. C.) and with plastic and Fiberglass coatings.

Write today for Quickdraft Engineering Data.

Quickdraft
CORPORATION
P. O. BOX 87-O • CANTON 1, OHIO

Expands Unit Heater Line

Peerless Mfg. Div., Dover Corp., Louisville, Ky., announces a line of suspended gas-fired unit heaters ranging in size from 175,000 to 300,000 Btu per hr.

This line implements its present line, making it complete in both propeller fan and blower models from 25,000 through 300,000 Btu per hr. All heaters are available in either aluminized steel or stainless steel heat exchangers. Propeller fan models are said to be extremely quiet because of their very rigid combination fan and motor support coupled with careful motor suspension.

Line is fully AGA approved for use with natural, LP, mixed and manufactured gases.

More information? Circle Item 114, postcard, last page.

Sediment Separator

A centrifugal sediment separator, Model F 1050, is introduced by Rain Jet Corp., Burbank, Calif. It removes sand, grit, pebbles, or any sediment from water flowing under pressure (but *not* leaves, moss, algae, chemicals, or bugs, the company warns).

The two-stage device, when placed in the suction

line, protects a pump from sand and grit. It is said to be particularly valuable on permanent underground or portable sprinkler irrigation systems for protecting sprinkler heads. Unit has several industrial uses, too.

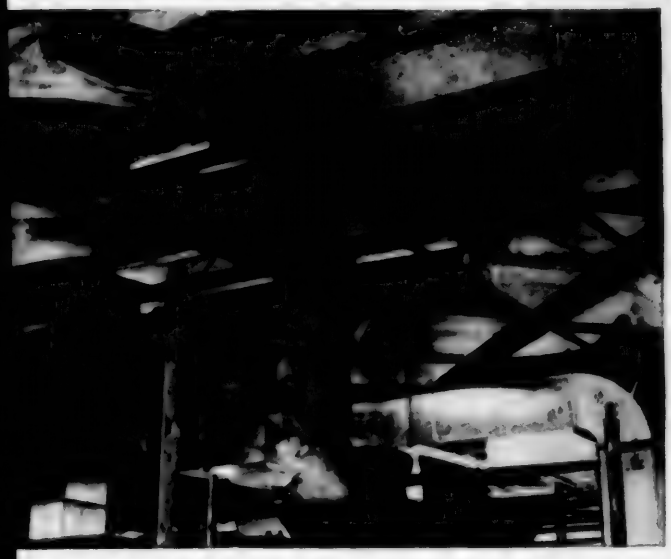
Separator is self-cleaning, non-clogging, discharging sediment into a trap. It has a transparent discharge leg for observation. Designed for use on ¾, 1 and 1¼-inch lines, unit's capacity ranges from 7 to 40 gpm. It is made of cast iron. An 00-mesh brass screen is provided as a secondary precaution, not as a basic factor in operation. Weight is 22 lb.

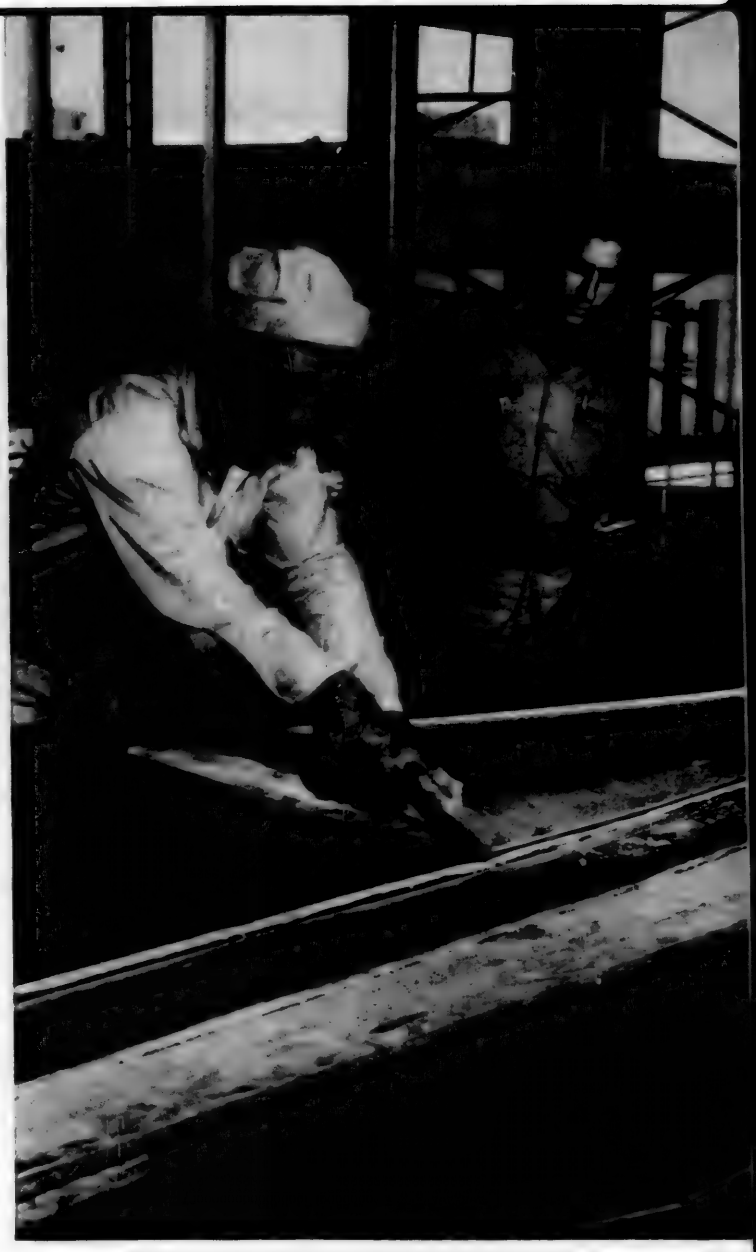
More information? Circle Item 115, postcard, last page.

Correction

In the May issue, page 120, there is a description of a water treatment feeder made by Heller Laboratories, Inc., Leonia, N. J. An error was made in stating that this company is an affiliate of Carrier Corp.

Right, PPG insulation is easily cut to size on the job. Left, Foreman Charles W. Booth, of Acheson Sheet Metal Company, supervises installation of ductwork. PPG Neoprene-coated Duct Liner meets all requirements of NBFU Bulletins No. 90-A and 90-B for ducts, and bears the label of Underwriters' Laboratories, Inc.





The inside story on a hush-up job in Tampa

(with PPG Fiber Glass Insulation, of course!)

It will be quiet, as well as comfortable around the new State Agency Building at Tampa, Florida, because PPG Fiber Glass Insulation has been installed in the ductwork of the heating and air conditioning system.

Job foreman Charles W. Booth of Acheson Sheet Metal Company, Jacksonville, installers of the ductwork, reports that the long life-expectancy of PPG Neoprene-coated Fiber Glass is of great importance in the choice of this insulation, because of the difficulty of replacement in a duct system.

It's what's inside that counts!

Mr. Booth says that PPG Insulation has extraordinary sound-deadening qualities which eliminate fan noise, has excellent thermal-barrier characteristics, and low resistance to air flow. In addition to ease of handling and installation, it will not be affected by humidity, won't swell, rot or decay . . . very important in Tampa-types of climates!

Get best results with PPG

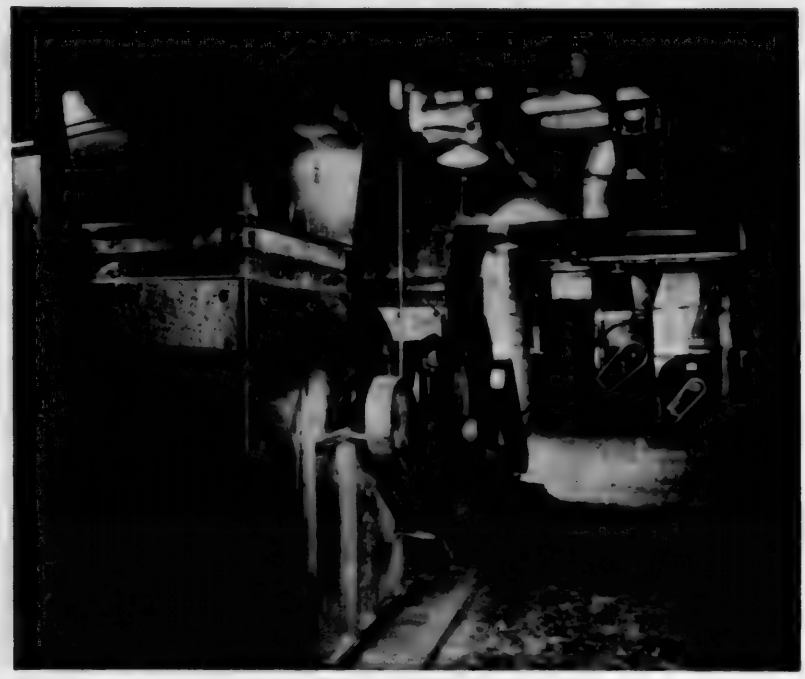
Available in a range of sizes, densities, and facings to meet any insulation specification. For more information, contact your nearest Fiber Glass Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Fort Wayne, Houston, Jacksonville, Kansas City, Los Angeles, Louisville, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Seattle and Washington.

FIBER PG GLASS — PITTSBURGH PLATE GLASS COMPANY

ANOTHER PEERLESS ELECTRIC SPECIAL BLOWER APPLICATION

United Air Lines Terminal Building, Idlewild Airport. Architects: Skidmore, Owings & Merrill. Consulting Engineers: Syska & Hennessy, Inc. General Contractors: Humphreys & Harding. Mechanical Contractors: A. D. Walker & Co., Inc.



Four of the 52 Peerless Electric Blowers. Shown are Philip M. Larkin (left), Senior Project Engineer, and Warren Dorrman (right), Project Supt. of A. D. Walker & Co., Inc.

"COMPLEX AIR HANDLING PROBLEMS MET BY PEERLESS ELECTRIC BLOWERS"

—Philip M. Larkin, Senior Project Engineer

Excessive heat transmission from an 800′ long, 20′ high glass front makes difficult the design target of 78° F maximum summer temperature with 50% relative humidity. In winter the need is for 65-70° F with humidity low enough to avoid condensation. Variations cannot exceed a minus 2% in temperature or plus 5% humidity. And the complete system must serve 45 different areas of the building, including the kitchen.

Tight space conditions and aircraft fumes added to the installation problem. The solution: 52 Peerless Electric Fans to supply and exhaust the 175,000 square foot building area. Peerless Engineers worked closely to make possible the necessarily delicate air balance.

No matter how complex your next job, let Peerless Electric engineer your air moving needs. Write: *Peerless Electric Division, H. K. Porter* Company, Inc., W. Market Street, Warren, Ohio.

PEERLESS ELECTRIC DIVISION **PORTER** H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

UTILITY PROMOTION PAYS OFF

(Continued from page 6)

shipments. Although the principal market for electric heat is in new-home construction, and rehabilitation of existing dwellings, it is also adaptable for use in commercial structures. Unit heaters are used mainly in commercial and industrial installations. Unit ventilators are primarily used in commercial and school construction.

In 1959, more than 21% of reported shipments of electric heating equipment were to the Pacific region of the United States—California, Oregon, and Washington. The East North Central region received slightly more than 15% of shipments. Regional destination of shipments is as follows:

Region	*Percent*
New England	4.3
Middle Atlantic	9.3
East North Central	15.1
West North Central	8.5
South Atlantic	10.4
East South Central	13.3
West South Central	5.0
Mountain	3.3
Pacific	21.4
Exports	0.3
Destination not available	9.1
Total	100.0

According to BDSA, it appears that more electric heating equipment should be sold in 1960 than in 1959. It would also appear, with lower electric rates for heating, that electric heating equipment will become increasingly competitive with other types of heating equipment in the ensuing years.

ROUNDED PROGRAM PROVIDED AT ASHRAE ANNUAL MEETING

A total of 575 members and guests registered at the sixty-seventh annual meeting of the American Society of Heating, Refrigerating and Air Conditioning Engineers held at Vancouver, B. C., June 13 to 15. This marks the first time that the society held a convention in Vancouver, and a well rounded program was provided.

Four technical sessions were provided, including symposiums on the

Domestic Refrigerator, Human Engineering and its Demands on Refrigerator Design, and Commercial Refrigeration. One afternoon was devoted to a number of forums on the following subjects:

Corrosion with window units,

Cryogenics,

Practical applications of foam insulation,

Economics of electric heating vs. fossil fuels for school buildings,

Aluminum tube refrigeration coils,

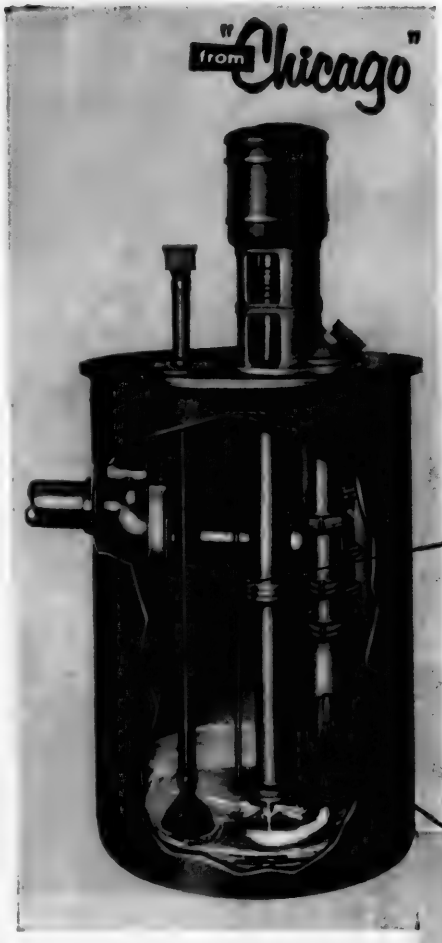
Reducing power needs for hot water systems, and

Noise in ventilating systems.

A number of awards were made. The F. Paul Anderson award was presented to Peter Ben Gordon of Wolf & Munier, New York City. A new award known as the Willis H. Carrier award, went to Aaron L. Brody of Whirlpool Corporation. The Klixon award was presented to John F. Harris and C. B. Sonnino. Both are from St. Louis. P. H. Ziel and J. S. Blossom, Cincinnati, Ohio, were the recipients of the Wolverine award. The ASHAE-Homer Addams, award which is given to honor a graduate student, was presented to Frank D. Farrington of the University of Arizona.

New officers who took office at the Welcome Luncheon are Walter A. Grant, vice president and director of engineering, Carrier Corp., Syracuse, N. Y., president; Robert H. Tull, Westinghouse Electric Co., Springfield, Mass., first vice-president; John Everetts, Jr., Philadelphia, second vice-president; and John Dube, president, Alco Valve Co., treasurer.

The board of directors consists of W. J. Collins, Jr., consulting engineer; J. F. Naylor, Jr., member of J. F. Naylor & Co.; T. J. White, branch manager, American-Standard Industrial Division; W. S. Harris, research professor, University of Illinois; W. L. McGrath, director of development, Carrier Corp.; J. W. May, director of technical training, American Air Filter Co.; Axel Marin, professor of mechanical engineering, University of Michigan; G. B. Rottman, consulting engineer; V. D. Wissmiller, Minneapolis-Honeywell.



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better than ever FLUSH KLEEN® clog-proof sewage pumping

NOW available with . . .

New SEALTRODE*
Sealed Electrode Floatless Pump Controller . . . the *only* pump controller *completely* free of becoming insulated or coated with grease or corrosive elements found in sewage and drainage water.

U.S. PATENT NO. 2,797,702

New FLO-THRU* Strainer
. . . the heart of the FLUSH KLEEN® System, is now available with FLUSH KLEEN® Sewage Pumps. Clear liquid flows continuously around and through the strainer without obstruction . . . at maximum solids loading.

High Wet Strength Paper Products and other solids . . . are never a problem.

*Patents Pending

Other Features

- Pumps handle clear liquid only
- Dependable, trouble-free pumping performance
- Minimum maintenance
- 100% standby capacity
- Longer pump life

OVER 13,000 FLUSH KLEEN® INSTALLATIONS

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profits come packaged.

Cleaver-Brooks Progress boilers pay off in time and labor savings

PROGRESS BOILER PROVES good things come in a *complete* package — especially when it comes to boilers. No need for you to do the manufacturer's work. No costly time-waste, boiler-building on the job!

Because Progress is a completely pre-engineered, factory-tested package — ready for hook-up to service lines — you save up to two days on installation alone.

PROFITS PROVE THE PACKAGE

And when it comes to worry-free installation, Cleaver-Brooks leaves nothing undone. Field starting service is just one example. A Cleaver-Brooks technician starts the boiler, trains the boiler attendant at no extra cost.

And Progress is easy to sell with quiet, low-cost operation. Four-pass, forced draft design means guaranteed efficiency; electronic controls, soft flame start.

The Progress boiler is built to the standards of industrial boilers. Available in 7 sizes to 2,010,000 Btu — oil, gas or combination oil/gas fired models.

You'll profit as a Progress contractor. For your Progress *Cooperative Wholesaler* contact your local Cleaver-Brooks sales representative listed in the yellow pages, or write Cleaver-Brooks Company, Dept. J, 315 E. Keefe Ave, Milwaukee 12, Wisconsin.

Cleaver-Brooks boilers are available in 19 sizes, 130 models, 15 to 600 hp. — steam or hot water, gas, oil or combination oil/gas fired. Illustration shows Model CB boiler as installed at Whirlpool Corp., St. Joseph, Michigan.

Cleaver Brooks®

TO MAKE PROGRESS SELL PROGRESS

BRIEFLY STATED

NEWS ITEMS

Dr. H. F. Stimson, a senior physicist in the Temperature Physics Section of the Heat Division, retired on April 30 after more than 42 years with the National Bureau of Standards. Dr. Stimson has pioneered many scientific advances in the field of heat measurement and is recognized as one of the foremost authorities in the world on the International Temperature Scale. His activities have included important research on the accurate determination of the thermal properties of water and steam, as part of an international program for the production of steam tables to be used as a basis for engineering and power plant design. He played a major role in drafting the International Temperature Scale of 1948.

WITH THE ENGINEERS

Appointment of William Waeldner as Director of Research is announced by ANEMOSTAT CORPORATION OF AMERICA, New York City. Mr. Waeldner joined the company in January 1946 as a research engineer. . .

Edward J. Wolff, Edward J. Wolff and Associates, Consulting Engineers, Chicago, Ill., has been named to the executive committee of the Federation Internationale des Ingenieurs-Conseils. He was elected by the International Federation at the organization's annual meeting, held June 1-4 in Stockholm, Sweden. Mr. Wolff, along with William W. Moore, Dames and Moore, Consulting Engineers, San Francisco, represented the CONSULTING ENGINEERS COUNCIL of the United States at the Stockholm Meeting. . .

A. E. LeVan has been elected vice-president in charge of research and development of AMERICAN MACHINE AND METALS, INC. Following his return from a current business trip to Europe, Mr.

Briefly Stated

LeVan will make his headquarters at the company's office in New York. Previously he had been in charge of research and development at the company's U. S. Gauge Division in Sellersville, Pa. . .

Appointment of W. R. McMahon to the newly created post of director of engineering and research for MODINE MANUFACTURING CO., Racine, Wis., has been announced. A member of ASHRAE and the fan coil coordinating committee of AMCA, IBR and ARI, Mr. McMahon has served as vice-president of AMCA and GAMA and as committee man for IUHA and CMA. . .

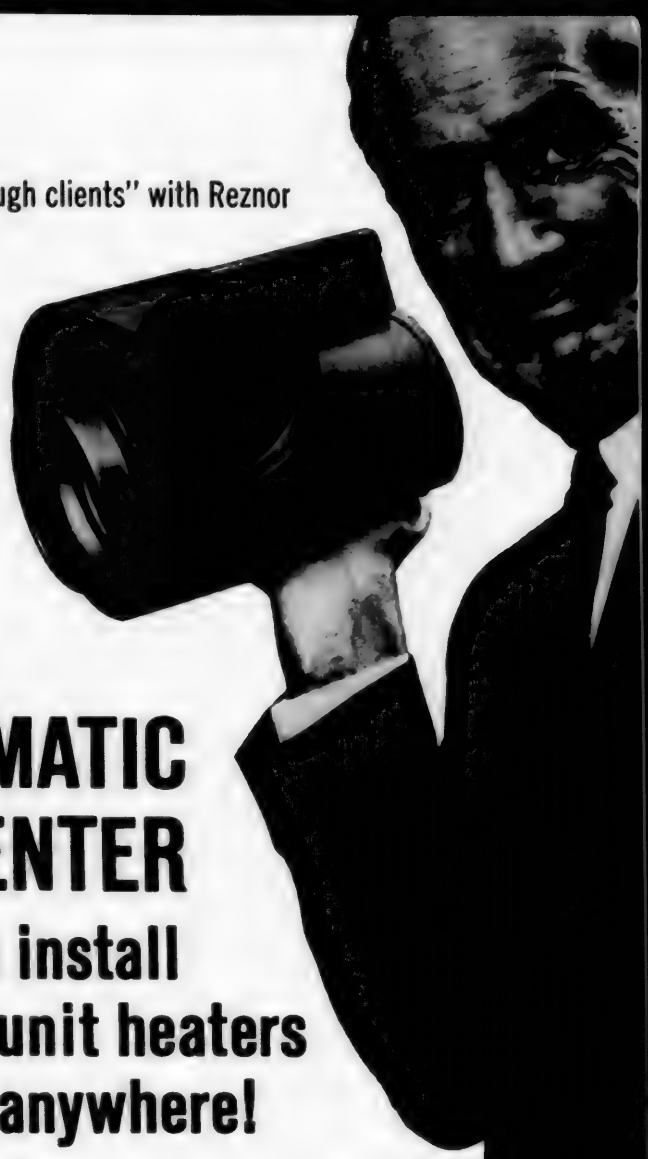
At their recent annual meeting in the Recess Club, the stockholders of ALBERT KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC., Detroit, Mich., re-elected its seven-man Board of Directors for the ensuing year. The Board members include: Geo. H. Miehls, Sol King, Sheldon Marston, G. K. Scrymgeour, R. E. Linton, G. S. Whittaker, and V. C. Wagner. Executive officers re-elected by the Directors are: Geo. H. Miehls, chairman and treasurer; Sol King, president; Sheldon Marston, executive vice-president; G. K. Scrymgeour, vice-president and secretary; R. E. Linton, G. S. Whittaker, V. C. Wagner, and Saul Saulson, vice-presidents. . .

UP ON TOP

Marvin H. Grove has been named chairman of the executive committee, and also has been appointed chief executive officer of WALWORTH COMPANY, New York, N. Y. Mr. Grove is also president of Walworth's wholly owned subsidiary, Grove Valve and Regulator Company. . .

The election of Matthew M. Gouger as executive vice president and member of the board of directors of FRICK COMPANY, Waynesboro, Pa., has been announced. Mr. Gouger, a vice president of General Aniline and Film Corp., New York City, was formerly president of DataGraphic Systems Inc., Santa Monica, Calif. A vice president and

Satisfy more "tough clients" with Reznor



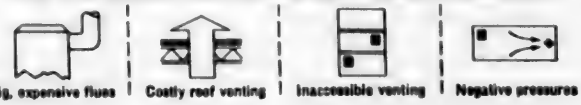
NEW AUTOMATIC VENTER lets you install Reznor unit heaters almost anywhere!

Now, with the Reznor Venter, you can install direct-fired Reznor heaters where you couldn't before—in multi-story buildings or structures with hard-to-get-at chimneys! You'll save money for your "tough clients."

The Venter, available exclusively with Reznor Heaters, is a motorized automatic vent exhauster that mounts directly on the heater. A 4-inch diameter vent pipe is all that is needed to carry burned gases to a sidewall—or down through the floor and out, if you choose. No more costly roof venting or big, expensive flues. Heaters operate more efficiently, too, especially if the room has an exhaust fan which creates a negative pressure.

There's a Venter for all Reznor Heaters up to 300,000 Btuh. Ask your representative for Catalog SA-5900, with data on all Reznor Heaters and the new Venter. Or write Dept. 64-Q, Reznor Manufacturing Co., Mercer, Pa.

USE THE REZNOR VENTER AND AVOID THESE PROBLEMS:



REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

a member of the executive committee of the American Management Association, Mr. Gouger is also an active member of the Commerce & Industry Association of New York, and the National Association of Manufacturers. . .

Joseph B. Elliott, formerly presiden of Schick, Inc., and Tele-Dynamics, Inc., and executive vice president for Radio Corporation of America in charge of all engineering, manufacturing and distribution of consumer products, has been named as president and general manager of YORK DIVISION OF BORG-WARNER CORPORATION, York, Pa., effective June 1. He succeeds Henry M. Haase who has headed York since 1956 and is now being transferred to Borg-Warner headquarters in Chicago. In addition to his divisional duties, Mr. Haase is also a vice president of Borg-Warner. . .

Alfred Bersted, a pioneer in small electrical household appliances, has been elected president of MCGRAW-EDISON COMPANY, Elgin, Ill., succeeding Max McGraw who has held the post for 60 years. Long associated with the industry, Mr. Bersted's career paralleled the growth and history of the electrical appliance business. His own manufacturing business began in 1918 in his father's tool and die shop, and grew until 1948 when Mr. Bersted merged with McGraw Electric. He became a vice president of McGraw Electric in 1949, and executive vice president in 1957 following the acquisition of Thomas A. Edison Industries and change of the corporate name to McGraw-Edison. In recent years, he has handled the company's appliance business. . .

CARRIER CORPORATION, Syracuse, N. Y., announced the election of four executive vice presidents and the formation of Carrier Air Conditioning Company as a division. New senior officers are Charles V. Fenn, Russell Gray, Melvin C. Holm and Walter Steitler. Each of these is a long-time Carrier employee with periods of service ranging from 23 to 31 years.

Carrier Air Conditioning Company will be responsible for the businesses now conducted by the Machinery and Systems and Unitary Equipment divisions of Carrier Corporation. The products involved range from room and home air conditioners to equipment used in large air conditioning systems. Mr. Gray has been designated president of this new division.

Certain staff groups of the Corporation, including those having to do with engineering, manufacturing and marketing, will be under the direction of Mr. Fenn, newly elected executive vice-president, who has also been named assistant to the president.

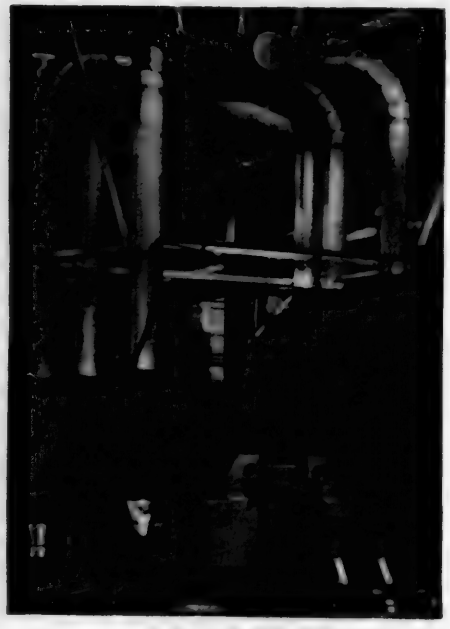
Operations of Elliott Company and Carrier Research and Development Co. will be directed by Mr. Steitler, executive vice president. . .

Lester T. Potter, president of Lone Star Gas Co., Dallas, has been nominated for president of AMERICAN GAS ASSOCIATION. Elections will be held October 12 at AGA's 42nd annual convention in Atlantic City. Other nominees are Edward H. Smoker, president, The United Gas Improvement Co., Philadelphia, first vice-president; John E. Hayke, president, The Brooklyn Union Gas Co., Brooklyn, second vice-president; and Charles H. Mann, treasurer, The Columbia Gas System, Inc., New York, treasurer. . .

Lee Epley has been named the advertising manager for AIRTEMP DIV., CHRYSLER CORP., Dayton, Ohio. He replaces Arthur L. Foster, who resigned to join an advertising agency in Bloomington, Ill. Succeeding Mr. Epley as sales promotion manager is Carl T. Miller, former supervisor of advertising production. . .

Harold P. Mueller, Sr., president and general manager of MUELLER CLIMATROL DIVISION OF WORTHINGTON CORPORATION, Milwaukee, Wis., turned these offices over to his son, Harold P. Mueller, Jr. on May 6. He continues service with Worthington as a director and in the area of special executive contact assistance to over-all corporate marketing. Mr. Mueller, Jr., has become the fourth generation to head Mueller Climatrol. L. J. Mueller, Sr. started the company in 1857 on Milwaukee's Reed Street. The first factory was a modest structure housing a combination hardware store and tin shop. Today, the Milwaukee plant alone has over 20

YOU SAVE MORE WITH FLEXAUST® HOSE



Thousands of successful installations prove that use of Flexaust hose and Portovent retractable duct with metal duct systems lower installation costs — but there are other important advantages

Exceptional abrasion resistance
Corrosion resistance
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Made of high quality neoprene coated fabrics 1¼ to 36" i.d.

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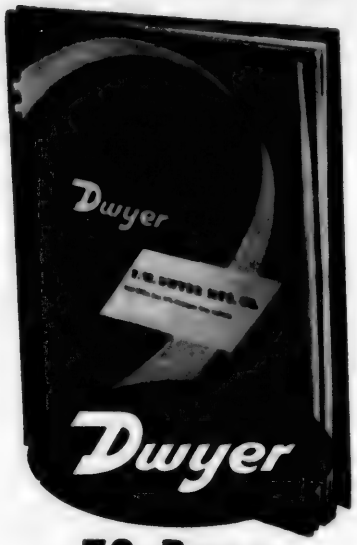

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Briefly Stated

acres of plant under roof. Mueller also operates a completely integrated plant in Alhambra, Calif. H. P. Mueller, Sr. joined the company in 1919 after service in France in the army. He was named sales manager in 1924, vice-president and general sales manager in 1929, and president and treasurer in 1931. Upon acquisition of Mueller Climatrol by Worthington Corporation in 1954, Mr. Mueller became president and general manager of the Mueller Climatrol Division and was also named a director of Worthington.

RECENT APPOINTMENTS

Appointment of Travis E. Mosier as sales representative in Moline, Ill., has been announced by WOLVERINE TUBE, DIVISION OF CALUMET & HECLA, INC., Allen Park, Mich. Mr. Mosier, formerly associated with Wolverine's General Sales Office in Allen Park, and for the past year sales representative in the Chicago metropolitan area, will now concentrate on the sale of the company's copper, copper alloy, and aluminum tube products and aluminum extruded shapes. He replaces T. E. Goodyear, who was recently promoted to the position of sales manager of the St. Louis District. . .

Appointment of Charles W. Lockhart as vice-president, sales was announced by BUFFALO FORGE COMPANY, Buffalo, N. Y. Mr. Lockhart joined the company's Engineering Department in 1936, was manager of the firm's San Francisco sales district from 1945 until 1953 and, most recently has served as sales manager of the Air Handling Division. . .

George B. Spears has been appointed a field service engineer for A. M. BYERS COMPANY's Pacific Coast Division office in San Francisco, Calif. Before joining Byers, Mr. Spears was employed by Associated Refrigeration Engineers. . .

WATTS REGULATOR COMPANY, Lawrence, Mass., announces the appointment of William P. Haney as manager of its Boston, Mass., sales office. Mr. Haney joined the Boston office in 1959 with a wide background in the sale and merchandising of plumbing and heating products. He succeeds Robert J. Tesar, who was recently appointed sales manager of the company. . .

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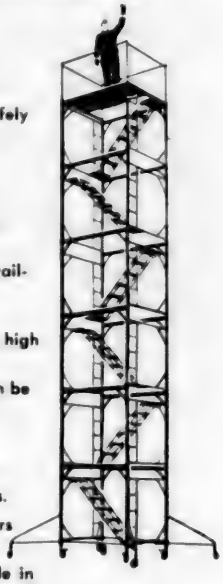

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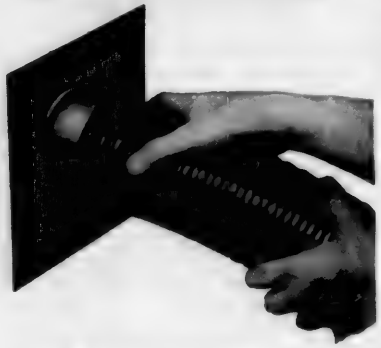

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Briefly Stated

Robert Groll has been appointed manager of the new West Hartford, Conn., branch office of ILG ELECTRIC VENTILATING COMPANY, Chicago, Ill. Mr. Groll replaces William McNeilly, who retired after 42 years of service. Mr. Groll formerly was a sales engineer in the Ilg New York office. . .

Coincident with this appointment is the announcement of the removal of the Ilg branch office in New Haven to 968 Farmington Avenue, West Hartford, Conn. . .

A series of appointments in the newly-established marketing section of the fiber glass division of PITTSBURGH PLATE GLASS COMPANY, Pittsburgh, Pa., has been announced. H. J. Paulus, formerly manager of building products sales, is appointed manager of reinforcement marketing. He joined the firm's fiber glass division in 1954 and also is a member of the American Chemical Society.

A. C. Pecora has been named manager of insulation marketing. He became associated with the company in 1947 and prior to his appointment had served as manager of planning and service since 1959. James D. Doughty, formerly manager of quality control, has been named to succeed Mr. Pecora. Mr. Doughty has been associated with the company since 1942.

E. M. Penney, who had served as manager of textile products sales since 1957, is appointed manager of industrial textile marketing. Mr. Penney joined the fiber glass division in 1953 and is a member of the American Association of Textile Technologists and Society of Plastics Industry.

W. T. Irwin, formerly manager of transportation products sales, has been named manager of transportation marketing. He has been associated with the firm since 1954 and also is a member of the American Chemical Society. . .

Marvin R. Clemons has been promoted to manager of the Pensacola sales office of THE TRANE COMPANY,

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La Crosse, Wis. Mr. Clemons joined Trane in 1951 and has served the Pensacola territory as a sales engineer for several years. He graduated from Louisiana State University with a Bachelor of Engineering degree in general engineering. Previous to joining Trane, he served four years in the U.S. Army Air Force. . .

H. W. Rainey, Jr., has been appointed marketing manager of STURTEVANT DIV., WESTINGHOUSE ELECTRIC CORPORATION, Hyde Park, Mass. Immediately prior to his new appointment, Mr. Rainey held the position of general sales manager. Mr. Rainey is a graduate of Georgia Tech with a degree in mechanical engineering. After graduation he joined the B. F. Sturtevant Company, which was acquired by Westinghouse in 1945. In 1955 he was made regional manager, central region, of the Sturtevant division and was made field sales manager in September, 1956. In 1959 he became general sales manager. . .

Two promotions have been announced at CHRYSLER CORPORATION'S AIRTEMP DIVISION, Dayton, Ohio. Guy R. Motto has been appointed product development engineer for heating products and John E. Fristoe as product analyst. . .

BARBER-COLMAN CO., Rockford, Ill., announced the appointment of E. A. Greenlee as division manager of its Air Distribution, Automatic Controls and Industrial Instruments Divisions. He was formerly sales manager of the Automatic Controls Division. Peter Van Dae succeeded Mr. Greenlee. . .

Appointment of Charles W. Ganzel as manager of pipe and tube sales has been announced by BETHLEHEM STEEL CO., Bethlehem, Pa. Mr. Ganzel has been manager of sales for Bethlehem's Cleveland district since 1956. He succeeds Edwin A. Buxton, retiring after more than forty-three years with the company. Frederic W. West, Jr., assistant manager, plate sales division, will succeed Mr. Ganzel at Cleveland. William E. Hotaling of the company's New Haven, Conn., sub-office will succeed Mr. West. . .

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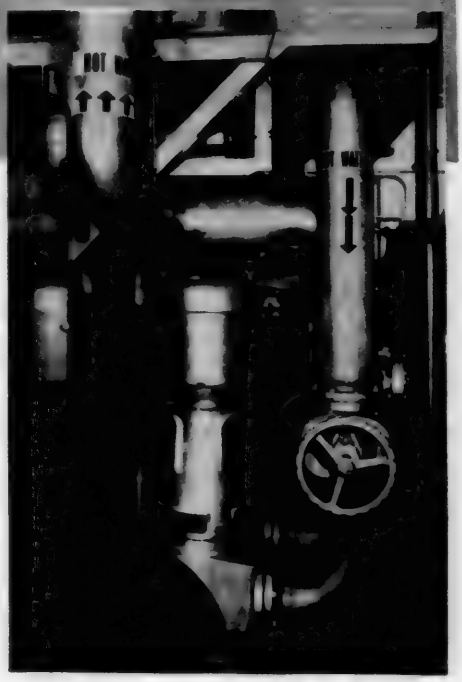

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

CRYOGENIC ENGINEERING CONFERENCE—1960 Cryogenic Engineering Conference sponsored by the University of Colorado and the National Bureau of Standards at the University of Colorado, Boulder, Colo. K. D. Timmerhaus, secretary, Chemical Engineering Department of the University, Boulder, Colo. .....**AUGUST 23-25, 1960.**

CHEMICAL SOCIETY MEETING—138th national meeting of the American Chemical Society, at the Statler Hilton Hotel, New York, N. Y. R. Avery, managing editor of the Society, 2 Park Ave., New York 16, N. Y. .....**SEPTEMBER 11-16, 1960.**

NACE SHORT COURSE—Short Course on Process Industry Corrosion, co-sponsored by the National Association of Corrosion Engineers Technical Committee on Corrosion Problems in the Process Industries, and Ohio State University, to be held on the University Campus, Columbus, Ohio. T. J. Hull, executive secretary of NACE, 1061 M & M Building, Houston 2, Tex. .....**SEPTEMBER 12-16, 1960.**

WELDING SOCIETY MEETING — Fall meeting of the American Welding Society, at the Penn-Sheraton Hotel, Pittsburgh, Pa. A. L. Phillips, AWS, 33 W. 39th St., New York 18, N. Y. ..**SEPTEMBER 26-29, 1960.**

ISA EXHIBIT AND MEETING—ISA Instrument-Automation Conference and Exhibit, in conjunction with the 15th annual meeting, at the Coliseum, New York, N. Y. W. H. Kushnick, executive director, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. .....**SEPTEMBER 26-30, 1960.**

CSA MEETING—66th annual meeting of Central Supply Association, at the Palmer House, Chicago. J. H. Peery, secretary of the Association, 221 N. LaSalle St., Chicago 1, Ill. .....**OCTOBER 5-7, 1960.**

ASSE MEETING—Annual meeting of the American Society of Sanitary Engineering, at the U. S. Grant Hotel, San Diego, Calif. S. Schwartz, secretary of the Society, 228 Standard Building, Cleveland 13, Ohio. .....**OCTOBER 9-14, 1960.**

AMERICAN INSTITUTE'S CONVENTION—Ninth annual convention of The American Institute of Supply Associations, Inc., to be held at the Americana Hotel, Bal Harbour (Miami Beach), Fla. Geo. T. Underwood, executive secretary of the Institute, 1628 Rhode Island Ave., N.W., Washington 6, D. C. .....**OCTOBER 23-26, 1960.**

CONSULTING ENGINEERS COUNCIL—Semi-annual meeting of the Board of Directors of Consulting Engineers Council, to be held in Pittsburgh, Pa. Headquarters to be announced later. L. N. Spiller, 326 Reisch Bldg., Springfield, Ill. .....**NOVEMBER 10, 1960.**

BRI FALL CONFERENCES—Fall Conferences of the Building Research Institute, at the Shoreham Hotel, Washington, D. C. Harold Horowitz, Assistant Director for Technical Programs, BRI, 2101 Constitution Ave., Washington 25, D. C. **NOVEMBER 14-16, 1960.**

ARI ANNUAL MEETING — First annual meeting of the Air-Conditioning and Refrigeration Institute, at the Hollywood Beach Hotel, Hollywood Beach, Fla. Geo. S. Jones Jr., manager of ARI, 1346 Connecticut Ave., N.W., Washington 6, D. C. **NOVEMBER 18-22, 1960.**

POWER EXPOSITION—24th National Exposition of Power & Mechanical Engineering, sponsored by the American Society of Mechanical Engineers, in conjunction with its annual meeting, to be held at the New York Coliseum, New York City. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. ...**NOVEMBER 28-DECEMBER 2, 1960.**

NATIONAL SYMPOSIUM ON TEMPERATURE—Third National Symposium on Temperature—Its Measurement and Control in Science and Industry, sponsored jointly by the American Institute of Physics, Instrument Society of America, and the National Bureau of Standards, to be held in Columbus, Ohio. C. L. Roberson, ISA, 313 Sixth Ave., Pittsburgh 22, Pa. .....**MARCH 27-31, 1961**

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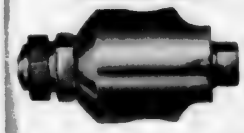

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WHAT READERS SAY

Caution on Refrigerant Piping

EDITOR, AIR CONDITIONING AND VENTILATING

I noticed with interest the schematic refrigerant piping hook-up in your June magazine issue. The hook-ups shown represent good practice as used by designers and mechanics for years.

A word of caution should be given with reference to one diagram indicating multi-evaporators stacked on same level with the compressor below. If the evaporators are individually controlled so that the bottom evaporator of the group can be off with the others active, there exists the possibility that the bottom evaporator will become logged with refrigerant or oil depending on exactly how the piping connection is made. If, in addition, the suction connection to the compressor is relatively short, there is the possibility that this logging or charge of oil and refrigerant will be driven directly into the operating valves of the compressor on the next call for cooling by the control system connected to the lowest evaporator. I have seen this actually happen in practice with disastrous results to connecting rods and valves. With such a control set-up the individual suction lines from the evaporator should be taken up and dropped into a common suction line returning to the compressor as indicated in other sketches of the refrigerant piping.

In general, all of the refrigerant piping diagrams indicated are an outgrowth of experience and thought with regard to the circulation of oil and liquid refrigerant in the system. If a little thought and understanding is devoted to the possible circulation of oil and liquid refrigerant in the piping it will not be necessary to retain a memory of all piping connections. Too frequently refrigerant piping is installed haphazardly according to the ideas of someone who has no real knowledge or understanding of these problems.

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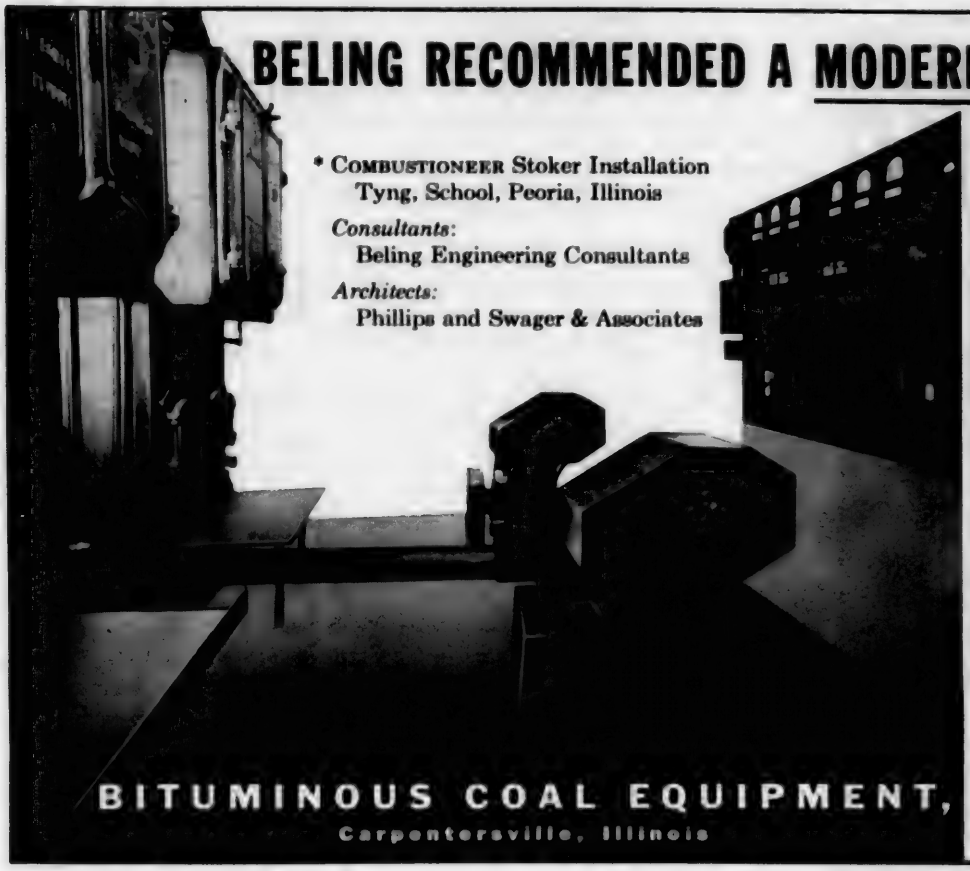

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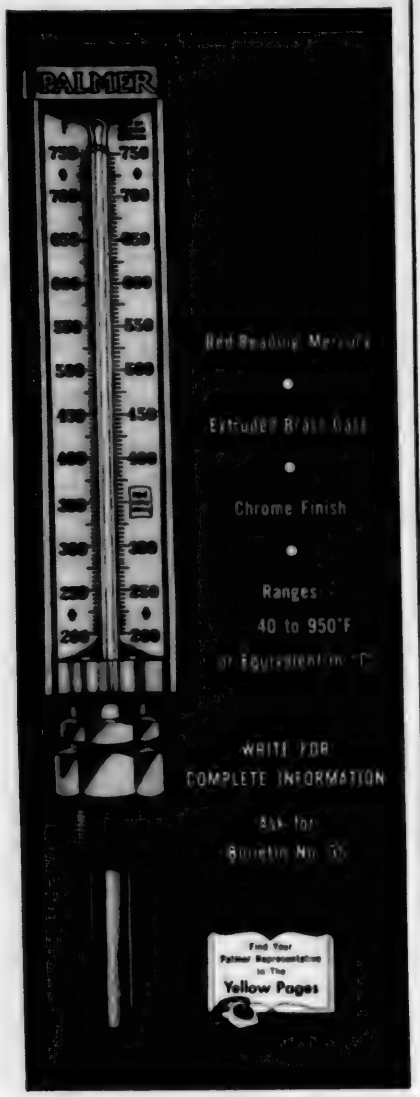

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APHABETICAL INDEX OF ADVERTISERS

A

Aerofin Corp. 5
Aerovent Fan Co., Inc. . . . . •
Air Devices, Inc. 28
Air Filter Corp. . . . . •
Alco Valve Co. . . . . •
Allin Manufacturing Co. 147
American Brass Co. 125
American Gas Association 8-9
American-Standard Industrial Div. . . . 40
Ammerman Co., Inc. 151
Armstrong Machine Works 1
Arno Adhesive Tapes, Inc. 135
Aurora Pump Div., New York Air Brake Co. 42

B

Babcock & Wilcox Co., Boiler Div. 39
Baker-Roos, Inc. 143
Barber-Colman Co. . . . . •
Bell & Gossett Co. 47
Bethlehem Steel Co. 45
Bituminous Coal Equipment, Inc. 149
Bohn Aluminum & Brass Corp. •
Bryan Steam Corp. . . . . •
Buensod-Stacey Corp. 21
Buffalo Forge Co. 49

C

Cambridge Filter Corp. 38
Carrier Corp. . . . . •
Chicago Pump Co. 139
Clarage Fan Co. . . . . Inside Back Cover
Classified Advertisements 150
Cleaver-Brooks Co., Boiler Div. 140
Construction Specialties, Inc. 134
Coyne & Delany Co. . . . . •
Cyclotherm Div., Crane Co. . . . . •

D

Davidson Fan Co. •
Dwyer, F. W., Manufacturing Co. 143

E

Elgo Shutter & Mfg. Co. •
Ellison Draft Gage Co., Inc. •
Ewing Manufacturing Co. . 147

F

Fairbanks, Morse & Co. . •
Field Control Div., Conco Engrg. Works, Inc. 11
Flexaust Co. 142

G

Grinnell Co. 12
Gustin-Bacon Manufacturing Co. 55

H

Halstead & Mitchell . . 41

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An established manufacturer with 25 years experience producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans. The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators.

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PRINTED FORMS available for immediate shipment. Heating & oil burner materials form, burner service record cards, service order forms, inspection information form, survey sheet and others. Also can supply BURNER SERVICE form in 3 part EZE-SNAP with 2 carbons in each set, 1200 sets Imprinted with your name, address and telephone, only $20.40. Send for samples—no obligation. Write Dept. AC, Dorro Day Systems, 29 20 58th St., Woodside 77, N. Y.

TECHNIQUES OF DUCT WORK ESTIMATING
LEARN HOW THE PRO'S FIGURE THE BIG JOBS

By poundage — Square footage — Linear footage — Fittings.

This information is ordinarily very closely guarded and is invaluable to the progressive shop or individual

Send check or money order $2.50
W.A.C. Co. Medway, Mass.

ALPHABETICAL INDEX OF ADVERTISERS

Harris, Arthur & Co. 149
Heat-Timer Corp. 146
Henry Valve Co. ..... Inside Back Cover
Hoffman Specialty Manufacturing Corp. 7

I

Ilg Electric Ventilating Co. 25
Illinois Testing Laboratories, Inc. 128
International Boiler Works Co. ..... *
Iron Fireman Manufacturing Co. 121

J

Jenkins Bros. 48
Jenn-Air Products Co., Inc. ..... *
Johns-Manville 16-17, 22-23
Johnson Service Co. ..... Back Cover
Josam Manufacturing Co. ..... *

L

Lattner, P. M., Mfg. Co. ..... *
Lawler Automatic Controls, Inc. 24
Lennox Industries, Inc. ..... Insert 33-36

M

Mamco Corp. ..... *
March Manufacturing Co., Inc. ..... *
Marsh Instrument Co., Div. Colorado Oil & Gas Corp. ..... Inside Front Cover
McDonnell & Miller, Inc. 43
McQuay, Inc. 53
Mercoid Corp. ..... *
Modine Manufacturing Co. 50-51

N

Nash Engineering Co. 56
National Tube Div., United States Steel Corp. 32
New York Blower Co. ..... *
Niagara Blower Co. 144

O

OPW-Jordan Corp. ..... *
Orr & Sembower, Inc. ..... *

P

Palmer Thermometers, Inc. 150
Patterson-Kelley Co., Inc. 20
Peerless Electric, Div., H. K. Porter Co., Inc. 138
Penn Ventilator Co., Inc. 10
Petro ..... *
Pittsburgh Plate Glass Co. 137
Power Flame Div., Inc. 130

Q

Quickdraft Corp. 136

R

Ray Burner Co. ..... *
Reading Tube Corp. 37
Research Products Corp. 52
Revere Copper & Brass, Inc. 27
Reznor Manufacturing Co. 141

S

Serco Co., Inc. ..... *
Siemon Manufacturing Co. 130
Skidmore Corp. 2
Sloan Valve Co. 54
Smith, Jay R., Mfg. Co. 132
Spence Engineering Co., Inc. 26
Sporlan Valve Co. 13
Spraying Systems Co. 147
Sterling, Inc. 133
Symmons Engineering Co. 148
Synchronous Flame, Inc. 148

T

Taco Heaters, Inc. ..... *
Todd Shipyards Corp. ..... *
Trane Co. 123
Tuck-Aire Furnace Co. ..... *

U

U. S. Valve & Engineering Co. ..... *
Union Carbide Development Co., Div. Union Carbide Corp. 14-15
United States Steel Corp., National Tube Div. 32

V

Vapor Heating Corp. ..... *
Ventil-Aire Corp. ..... *

W

Wade Manufacturing Co. 29
Wagner Electric Corp. 129
Waterloo Register Co., Inc. 152
Watsco, Inc. 149
Watts Regulator Co. ..... *
Webster Engineering Div., Midland-Ross Corp. ..... *
Webster, Warren & Co., Inc. 30-31
Weil-McLain Co. 46
Weil Pump Co. 145
Western Engineering & Mfg. Co. 131
Wheeling Steel Corp. 18-19
Wing, L. J., Mfg. Co. 44
Wiremold Co. 144

Y

Yuba-Aimco Div., Yuba Consolidated Industries, Inc. ..... *
Yuba Consolidated Industries, Inc., Yuba-Aimco Div. ..... *
Yuba Consolidated Industries, Inc. Yuba Heat Transfer Div. 127
Yuba Heat Transfer Div., Yuba Consolidated Industries, Inc. 127

* Advertiser appeared in preceding issue

AirMpeler

LO-BOY
CENTRIFUGAL
ROOF EXHAUSTERS

Enhance The Beauty Of Building Skylines

Lowest Silhouette Design

FORWARD OR BACKWARD CURVE WHEEL WITHIN . . . . OR OUT OF SCROLL HOUSING

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

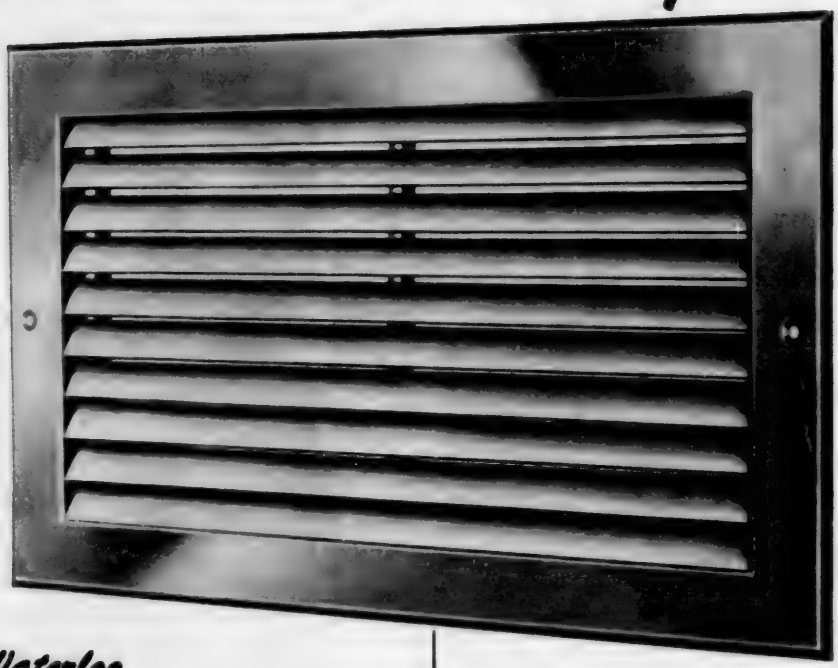
LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY**
- **BEAUTY**
- **PROVEN PERFORMANCE**

Write for bulletin AC-100-60

AMMERMAN CO., INC.
P. O. Box 182 Stillwater, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

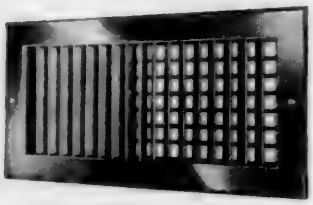
WATERLOO
Return Air Grilles



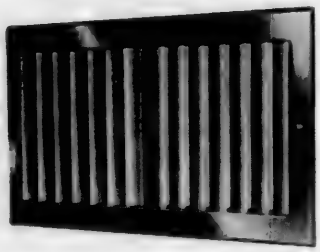
MODEL 3HD

Waterloo Offers a Complete Line

TYPICAL WATERLOO UNITS:



WATERLOO SUPPLY GRILLES ★ MODEL 2V



WATERLOO CURVED LOUVER GRILLES ★ MODEL 1CV2

WATERLOO AIRLINE GRILLES MODEL AL1

WR-118

Rugged Construction Smooth Contoured Fins

Waterloo Series 3 *return air grilles* are ruggedly constructed for commercial installations. The smooth contour of the fin results in a nearly sight-proof grille without decreasing the free area. Where straight deflection is desired, the fins are also hemmed at the edge for added protection. Waterloo *return air grilles* are available with either horizontal or vertical fins.

Series 3 *return air registers* feature the same rugged construction and incorporate the use of the opposed blade damper. This may be snapped on or off the unit and is adjustable from full open to closed for balancing of the air system.

WATERLOO *Air Diffusion* **EQUIPMENT**

Write for the comprehensive catalog which gives complete data.

WATERLOO REGISTER COMPANY, INC.

P.O. BOX 72, WATERLOO, IOWA

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

PACKLESS RADIATOR VALVES ..... are but part of the extensive line of heating specialties offered by Marsh Instrument Co. Other products include traps, gages, and thermometers. Catalog is available.
Inside Front Cover — Item 200

TRAP INSTALLATION DATA ..... are contained in Armstrong bulletin which contains diagrams, selection data, tables, etc., as well as output ratings for all models of 30 makes of unit heaters. Also, 48-page Armstrong Steam Trap book tells how to correctly size, install and maintain steam traps for any pressure, temperature, load.
Page 1 — Item 201

HEATING PUMPS ..... made by Skidmore feature mechanical shaft-seal, close-coupled design, giving more capacity and better performance. You can specify Skidmore right down the line, whatever the application, wherever you need a dependable heating pump. Information available.
Page 2 — Item 202

HIGH PRESSURE WATER COILS ..... were especially built by Aerofin Corp. to withstand the maximum operating pressure of 350 psi in the First National City Bank's new building in New York City. Information on these and other coils are available.
Page 5 — Item 203

STEAM TRAPS ..... are available in a complete line from Hoffman Specialty Mfg. Corp. They are designed and constructed to give economical removal of condensate from steam lines, long in-use life, and easy access for servicing. Information is offered.
Page 7 — Item 204

COMFORT COOLING ..... is insured for insurance company's new home office with gas-operated Carrier absorption refrigeration equipment. System is called the essence of simplicity and economy. Information is offered.
Pages 8-9 — Item 205

ROOF EXHAUSTERS ..... made by Penn Ventilator Co. provide the first direct discharge design for removing foul air quietly. Design reduces turbulence while increasing air flow. Bulletin is offered.
Page 10 — Item 206

SMOKE STACKS ..... become true chimneys when you specify installation of a Field draft control. Units provide draft precisely controlled to the needs of gas combustion. Information is available.
Page 11 — Item 207

BETTER PIPE HANGERS ..... offered by Grinnell cost no more than competitive makes. You get a wider choice of types and sizes; better quality control; published ratings for all hangers; faster delivery from warehouses nationwide; and more responsible field service. Information is available.
Page 12 — Item 208

COMBINATION MOISTURE AND LIQUID indicator manufactured by Sporlan Valve Co. offers a number of worthwhile firsts, including the fact that disassembly is not required during installation. Bulletin is available.
Page 13 — Item 209

NEW CUBE TYPE AIR FILTER ..... offered by Union Carbide has Dynel filter medium which stops and holds unusually large quantities of dirt. Lasts six times longer. As dirt builds up on inside face, air flow is shunted to large filtering area of four sides. Information is available.
Pages 14-15 — Item 210

SWEAT-PROOF INSULATION ..... called Aerotube by Johns-Manville is a flexible foamed plastic pipe insulation that cuts installation costs in half. Has a built in vapor barrier. Recommended for heating, plumbing and air conditioning service. Brochure available.
Pages 16-17 — Item 211

GALVANIZED STEEL SHEETS ..... called Softite by Wheeling Steel Corp. can be bent, hemmed, scribed, punched, formed, notched, drawn, welded, crimped, and sheared. Information is available.
Pages 18-19 — Item 212

STORAGE WATER HEATER ..... for commercial, industrial and institutional use is offered by Patterson-Kelley. Indirect gas-fired unit boasts many advantages. Catalog is available.
Page 20 — Item 213

ADDING AIR CONDITIONING ..... to an existing building need not be a weighty problem. Buensod dual duct is 100% compatible with existing systems. Information is available.
Page 21 — Item 214

PIPE INSULATION ..... made of fiber glass by Johns Manville provides exclusive spring-hinge action. It has a remarkably low "k" factor which means lower fuel and power costs. Information is available.
Pages 22-23 — Item 215

TEMPERATURE REGULATOR ..... manufactured by Lawler Automatic Controls provides unequalled accuracy in temperature control for industry's most exacting requirements. Information is available.
Page 24 — Item 216

UPBLAST VENTILATOR ..... mounted directly over a roof opening gives high-speed, vertical exhaust from either duct or open areas. Manufacturer, Ilg Electric Ventilating Co., offers descriptive bulletin.
Page 25 — Item 217

WHEN REGULATORS DEVELOP ..... trouble, engineers want to get them back on the line quickly. That's one reason why more engineers are standardizing on Spence regulating valves with externally mounted pilots. Bulletin is offered.
Page 26 — Item 218

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

COPPER DWV TUBING .....
offered a savings that permitted doing two school jobs for the same price as rustable pipe. Manufacturer of this tubing, Revere Copper & Brass, offers information on its copper water tube.
Page 27 Item 219

CORRECT AIR HANDLING .....
with Agitair products is being provided in thousands of applications for all kinds of commercial and industrial businesses. An extensive line includes mixing boxes, air diffusers, registers, filters and exhausters. Information is available.
Page 28 Item 220

THE BASIC FLOOR DRAIN .....
as manufactured by three companies receives a design comparison in ad. On this basis, Wade Mfg. Co. states that their floor drain is unequalled. Information is available.
Page 29 Item 221

UNIT VENTILATOR .....
from Warren Webster ventilates as it heats or cools for complete classroom comfort. Room and outdoor air are blended by a damper of exclusive design which assures proper ventilation and draft-free comfort. Brochure gives details.
Pages 30-31 Item 222

SNOW MELTING SYSTEM .....
made with modern steel pipe spells instant death for all snowflakes when you use USS National Steel pipe, for 60 years the consistent choice of architects, engineers and contractors. Systems are ideal for office buildings, hotels, churches, theaters, terminals, and highway toll gates. Information is available.
Page 32 Item 223

HEATING INDUSTRIAL BUILDINGS ...
is a problem because these buildings are hard to heat and have high heat losses. Lennox Industries, Inc. manufactures a line of products for industrial space heating and offers information on the proper application of these products. See Ad.
Insert 33-36 Item 224

IN TUBING .....
nothing beats copper; and in copper, nothing beats Reading. Company has finned copper tube, copper water tube, copper refrigeration tube, and others. Information is available.
Page 37 Item 225

HIGH VELOCITY FILTERS .....
from Cambridge Filter Corp. will keep 1,300,000 cfm of air really clean from top to bottom in the new office building of The Equitable Life Assurance Society of the U.S. Information is available.
Page 38 Item 226

PACKAGE BOILERS .....
from Babcock & Wilcox are cutting heating costs 22% for the country's third largest building, the American Furniture Mart. Boilers also cut space requirements in half and require fewer operators. Information is available.
Page 39 Item 227

AIRFOIL BLADED FANS .....
from American-Standard Industrial Div. have an exclusive radial rim wheel design that substantially lowers air velocity through the blast area of the wheel. This reduces turbulence and results in unusually quiet fan operation. Bulletin is offered.
Page 40 Item 228

AIR HANDLERS .....
are manufactured by Halstead and Mitchell in 880 to 47,500 cfm range. They are sturdy, quiet and economical. Bulletin is offered.
Page 41 Item 229

CONDENSATION RETURN UNITS .....
are manufactured by Aurora Pump in capacities to 15,000 EDR and to 23 gpm. Packaged units feature high efficiency, compactness, and low horsepower requirement. Higher capacity units are also available. Information is offered.
Page 42 Item 230

FOUR APPLICATION BULLETINS .....
are offered by McDonnell & Miller as an aid to engineers in the selection and use of the company's products. Use coupon in ad to obtain these engineering aids.
Page 43 Item 231

CAST IRON BOILERS .....
from Weil-McLain feature great flexibility of installation in new and existing installations, and have additional advantages also. Information is available.
Page 46 Item 232

PRIMARY AND SECONDARY PUMPING
as conceived and developed by Bell & Gossett engineers both reduces pump horsepower and saves fuel by improving heat control where multiple buildings, or multiple zones within a building, are to be heated with circulated water. Booklet gives details.
Page 47 Item 233

NO VALVE PROBLEMS .....
will be encountered at the new Mirro Aluminum Co. rolling mill because management selected Jenkins valves to control 15 miles of piping. Information on company's valves is available.
Page 48 Item 234

CENTRAL AIR CONDITIONING .....
requires quality units, such as available from Buffalo Forge, to fit your plant layout, to deliver an exact climate, and to insure low maintenance operation. Bulletin is offered.
Page 49 Item 235

FAN-COIL UNITS .....
manufactured by Modine Mfg. Co. permit full-room decorating in buildings with curtain walls or floor-to-ceiling windows. Although midgets in size, these units are giants in performance. Bulletin is offered.
Pages 50-51 Item 236

INDUSTRIAL AIR FILTER .....
from Research Products Corp. gives you more, costs you less, and provides many features for heating or air conditioning. Information is available.
Page 52 Item 237

INDIVIDUAL ROOM UNITS .....
are called ideal for apartments, motels, hotels, offices, hospitals or any installation utilizing a central station heating and cooling system. McQuay, Inc., offers information.
Page 53 Item 238

CONCEALED FLUSH VALVES .....
from Sloan Valve Co. have alternate handle opening which means the valves can be installed to avoid obstruction. Information is offered.
Page 54 Item 239

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. All advertisements are digested here except those that are received too late for inclusion in this listing.

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

ONE-PIECE PIPE INSULATION ..... molded of fine glass fibers and called Snap-On by Gustin-Bacon Mfg. Co. provides an attractive, finished pipe insulation job when appearance is also important. Information is available.
Page 55 Item 240

FORCED DRAFT FIRING ..... provided by Iron Fireman eliminates the need for high stack of the type required for natural draft firing. Electrical power consumption reduced. Quieter, more compact, more accessible. Units completely packaged. Details available.
Page 121 Item 241

GAS-FIRED HEATERS ..... from Trane have advanced styling and a compact design. High-performance blower and propeller units, plus duct models, are approved for downstream operation. Information is available.
Page 123 Item 242

COST-CUTTING KITS ..... available from The American Brass Co. help you rough in hot and cold water lines faster, easier and better. Anaconda Quik-Ruf kits are convenient and reasonably priced. Information is offered.
Page 125 Item 243

PIPING EXPANSION PROBLEMS ..... have been carefully handled by Adsco for more than 80 years. Service ranges from engineering through manufacture. Comprehensive catalogs are offered.
Page 127 Item 244

AIR FLOW SYSTEMS ..... can be balanced once and for all time with the Alnor Velometer. Instant reading of air flow at outlets and draw of air from returns gives an accurate check on engineered systems. Information is available.
Page 128 Item 245

STEAM TRAP TESTING ..... is accurate and positive with an Alnor Pyrocon. By instantly registering the temperatures on each side of a trap, this device will spot trouble right at the start before failure becomes serious. Bullletin is offered.
Page 128 Item 246

RESILIENT MOUNTED MOTORS ..... in ratings through 10 horsepower are manufactured by Wagner Electric Corp. These polyphase motors feature quiet, vibration-free performance. Information is available.
Page 129 Item 247

BURNER CATALOG ..... offered by Power Flame Div., Inc., includes a complete range of models and sizes in atmospheric burners, power burners, and combination burners. All designed for lowest installation and maintenance cost.
Page 130 Item 248

AIR EXHAUSTING DEVICES ..... in 12 different types are illustrated in this month's ad by Western Engineering & Mfg. Co. Information on these ventilators is available.
Page 131 Item 249

FOR WALL-HUNG FIXTURE ..... installations, Jay R. Smith Mfg. Co. recommends its long barrel adjustable fittings and chair carriers. They save time and material. Information is available.
Page 132 Item 250

SELF-CONTAINED CONTROL ..... from Sterling Inc. provides accurate, individual room temperature control for steam or hot water systems. It eliminates thermostats and zone valves. Information is available.
Page 133 Item 251

AIR INTAKES AND EXHAUSTS ..... for unit air conditioners and other ventilation requirements can receive a neat treatment with cast aluminum brick size vents and blocks manufactured by Construction Specialties Inc. A catalog is available.
Page 134 Item 252

SEALING DUCTS ..... and insulation is accomplished quickly and surely with Arno Ductape. It sticks instantly and permanently to any surface and is available in a flame resistant model where fire hazard exists. Information and sample are available.
Page 135 Item 253

POWER-DRAFT UNITS ..... designed for residential, commercial and industrial applications are offered by Quickdraft Corp. They provide maximum heating or exhausting efficiency at lowest cost. Engineering data bulletin is available.
Page 136 Item 254

FIBER GLASS INSULATION ..... made by Pittsburgh Plate Glass has extraordinary sound deadening qualities which eliminate fan noise. Excellent thermal-barrier. Low resistance to air flow. Easy to handle and install, and not affected by humidity. Information is available.
Page 137 Item 255

SPECIAL BLOWER APPLICATIONS .... are easily handled by Peerless Electric blowers. One such problem was the supply and exhaust for new United Airlines Terminal Building. Information on company's air handling products is offered.
Page 138 Item 256

CLOG-PROOF SEWAGE PUMPING .... is better than ever with Chicago Pump's Flush Kleen units with sealed electric floatless pump controller, the only pump controller that will not become insulated or coated with grease or corrosive elements found in sewage and drainage water. Information available.
Page 139 Item 257

PACKAGED BOILERS ..... from Cleaver Brooks ensure profits by eliminating costly waste of time building the boiler on the job. Units completely pre-engineered, factory tested, ready for hookup to service lines. Information is available.
Page 140 Item 258

NEW AUTOMATIC VENTER ..... from Reznor Mfg. Co. permits installation of direct-fired heaters in places heretofore difficult or impossible—in multistory buildings or structures with hard to get at chimneys. Catalog is offered.
Page 141 Item 259

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

FLEXIBLE HOSE ..... made by Flexaust of high quality metal and neoprene coated fabrics has proven lower in installation costs and provides exceptional abrasion resistance, noise absorption and easy relocation of hoods and machines. Full details available.
Page 142 Item 260

NEW SCAFFOLD ..... announced by Baker-Roos incorporates wider platform area and other important advantages. It sets up fast, stacks to 20 ft. high without stabilizing, and locks together safely with spring-loaded positive action lock latches. Bulletin is available.
Page 143 Item 261

INSTRUMENT MANUAL ..... is offered to all users of gages and controls by F. W. Dwyer Mfg. Co. The 72-page manual includes engineering data and product descriptions.
Page 143 Item 262

FLEXIBLE AIR DUCT ..... from The Wiremold Co. saves time and money on every connection since two lengths join simply by screwing them together. Information is available.
Page 144 Item 263

CONTROLLED HUMIDITY ..... air conditioning system removes atmospheric moisture by direct contact with an absorbent liquid in a compact spray chamber. Two bulletins, available from Niagara Blower Co., describe this method.
Page 144 Item 264

VERTICAL CIRCULATING PUMP ..... manufactured by Weil Pump Co. is an all ball bearing pump designed for continuous operation. Quiet operation and efficient performance are featured. Bulletin is available.
Page 145 Item 265

ZONE CONTROL VALVE ..... manufactured by Heat-Timer Corp. is constructed to last. The valve's packless design means no friction, no wear, and no adjustment. Brochure is offered.
Page 146 Item 266

POSITIVE SEALING INDICATORS ..... made by Allin Mfg. Co. proven on thousands of production line installations have one piece extension gasket for positive sealing and fool-proof assembly. Six sizes. Complete line catalog available.
Page 147 Item 267

MORE HOT WATER ..... can be had, and fast, too, with a Ewing automatic heavy-duty vertical hot water heater. And for less cost because it requires no expensive storage boilers, is simple and easy to install and operate, requires no maintenance, and saves valuable floor space. Information available.
Page 147 Item 268

SPRAY NOZZLES ..... from Spraying Systems Co. lower the cost of conditioning air because the company designs them for exact control of spray characteristics and offers them in a complete range of sizes for selecting the exact capacity needed. Two bulletins give all the details.
Page 147 Item 269

PRESSURE BURNERS ..... for dual-fuel, gas, or oil are offered by Synchronous Flame. Designed for hard-to-fire jobs: all types of boilers, warm air furnaces, and ovens. Many standard features which are extras on other burners. Detailed information offered.
Page 148 Item 270

COMBINATION VALVE ..... for tub and shower is offered by Symmons Engineering Co. It provides full flow and temperature control with only one moving part. Bulletin which is available gives all details.
Page 148 Item 271

MODERN STOKER OFFERED ..... by Bituminous Coal Equipment, Inc. Features factory pre-wired panels, mechanical draft control, fully automatic sequence system, simplicity of operations, true efficiency, and burns coal, the most economical fuel available. Information is offered.
Page 149 Item 272

LINE TAP VALVES ..... from Watsco Inc. provide a positive sealed port at low cost, and will test, charge, and discharge a system in minutes. Information is offered.
Page 149 Item 273

INDUSTRIAL FLOATS ..... for any liquid level control problem are manufactured by Arthur Harris & Co. Models are available for high temperature, high pressure service, and for handling corrosive liquids. Catalog is offered.
Page 149 Item 274

INDUSTRIAL THERMOMETER ..... is offered by Palmer Thermometers, Inc., with advantages including red-reading mercury, extruded brass case, and chrome finish. Bulletin is available.
Page 150 Item 275

CENTRIFUGAL ROOF EXHAUSTERS ... of lowest silhouette design by Ammerman enhance the beauty of building skylines. Forward or backward curved wheels within or out of scroll housing. Bulletin is available.
Page 151 Item 276

RETURN AIR GRILLES ..... are ruggedly constructed for commercial installation. They are part of a complete line of air diffusion equipment available from Waterloo Register Co. Comprehensive catalog is offered.
Page 152 Item 277

POWER ROOF VENTILATOR ..... called the Clarage Centrilator can save space and money on your next air handling job. It requires no floor space, provides unequalled accessibility, and requires minimum installation cost. Bulletin is offered.
Inside Back Cover Item 278

PRECISION PILOT POSITIONER ..... from Johnson Service Co. is designed for application to the larger size valves for precise repositioning even for very small changes of air pressure from the controlling instrument. Bulletin gives necessary details.
Back Cover Item 279

CIRCLE FOR NEW EQUIPMENT AND LITERATURE INQUIRIES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132

CIRCLE FOR AD-DIGEST INQUIRIES

133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153
154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216
217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237
238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258
259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

PLEASE PRINT CLEARLY

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....Zone ....State .....

Please send and bill me for the books circled: August '60

TO ORDER BOOKS DESCRIBED BELOW

A B C D E F G H I J K L M N O P Q R S T U V

This service is not available to overseas readers. Cards are void after November 1, 1960.

FIRST CLASS
PERMIT NO. 83
NEW YORK, N. Y.

BUSINESS REPLY CARD
NO POSTAGE NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

AIR CONDITIONING, HEATING and VENTILATING
93 WORTH STREET
NEW YORK 13, N. Y.

READERS SERVICE DEPT.

BOOKS TO HELP YOU WITH YOUR DESIGN PROBLEMS

DESIGN OF AIR CONDITIONING SYSTEMS

by F. W. Hutchinson

115 full-page charts solve problems of air conditioning system design involving cooling load, duct design, psychrometrics, solar energy, comfort conditioning, panel cooling, etc. For each chart the engineering and mathematical background plus design example and solution are given. 336 Pages, 118 Illus., $7.00.

TO ORDER CIRCLE B ON CARD ABOVE

DESIGN OF HEATING AND VENTILATING SYSTEMS by F. W. Hutchinson

96 full-page charts solve problems of heating and ventilating involving load determination, duct design, panel heating, solar heating and combustion analysis. Companion book to Design of Air Conditioning Systems. Same methods to explain and solve problems are used. 320 Pages, 96 Charts, $7.00.

TO ORDER CIRCLE C ON CARD ABOVE

COMBINATION OFFER

Both of the above books by Prof. F. W. Hutchinson, $12.50.

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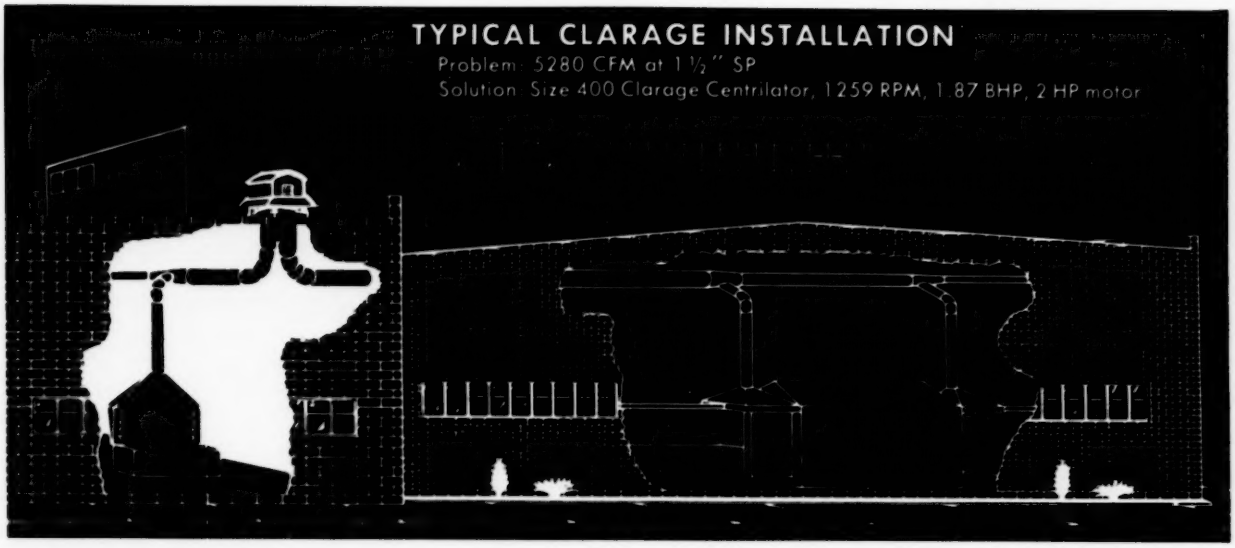
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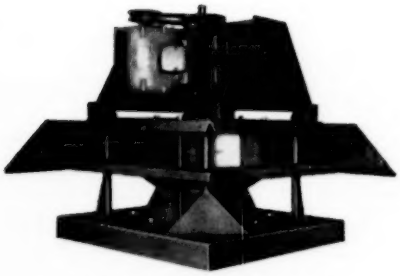

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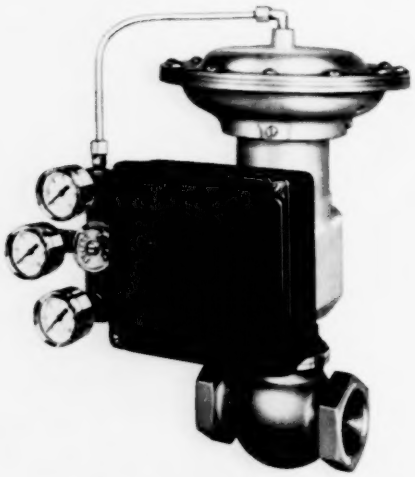

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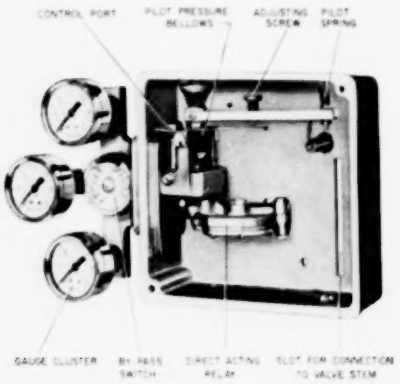

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